

Keratitis After PRK Enhancement Post-LASIK

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CASE PRESENTATION

A 42-year-old male underwent LASIK in both eyes approximately 1 year ago. His preoperative manifest refraction was $-4.00 +1.25 \times 90$ OD and $-3.75 +1.50 \times 85$ OS. Both eyes refracted to 20/20. Surgery was uneventful. He returned to the original surgeon for a possible enhancement of his left eye. The residual refractive error in his right eye was -0.25 D. The manifest refraction of his left eye was $-1.00 +1.00 \times 80$. His BCVA was 20/20 OU.

The patient underwent an uneventful PRK with mechanical removal of the epithelium in his left eye. His 1-day postoperative visit was without incident; he had a large epithelial defect and a visual acuity of 20/60 with the bandage contact lens in place. He returned to the original surgeon 3 days postoperatively with a complaint of pain and decreased vision. His UCVA was 20/400 OS, which did not improve with manifest refraction.

The patient is referred to you for management 5 days after the enhancement procedure. He is taking Lotemax (loteprednol; Bausch & Lomb, Rochester, NY) and Vigamox (moxifloxacin; Alcon Laboratories, Inc., Fort Worth, TX)



Figure 1. A slit-lamp photograph shows a diffuse keratitis with opacification of the corneal stroma measuring 7.5 X 9.0 mm in diameter.

every 2 hours, and the original bandage contact lens is in place (Figure 1). How would you proceed?

MITCHELL A. JACKSON, MD

Infection following a “routine,” uncomplicated PRK procedure can be quite disturbing to the surgeon and potentially visually devastating to the patient. It is easy, in retrospect, to look at this case and be critical of why an enhancement was performed on a 42-year-old with a plano -1.00×170 correction in one eye. As a result, an unfortunate although rare complication has occurred. The only time I would consider enhancing such an eye in a presbyopic patient would be if it were the dominant eye and were giving the patient a difficult time (the case presentation does not state whether the treated eye was dominant or not).

Nevertheless, the treatment of a postoperative infection after PRK is necessary to prevent corneal ulceration, endophthalmitis, corneal scarring, and/or the loss of a

previously created LASIK flap if PRK is performed as an enhancement after LASIK. In this case, the patient still has a large epithelial defect on postoperative day 5 and exhibits diffuse stromal keratitis. The acuteness of the infection most likely suggests a bacterial origin, and the most common pathogens causing infectious keratitis following PRK are gram positive (ie, *Staphylococcus aureus*, including the methicillin resistant variety, *Streptococcus pneumoniae*, and *Streptococcus viridans*).^{1,2} In this case, *Pseudomonas aeruginosa* from the overly long use of the bandage contact lens must be considered as well.

I would immediately remove the bandage contact lens and send it as well as corneal scrapings for culturing. I would have the patient discontinue steroid treatment until the infection was under control. In this case, I would exchange the

Vigamox for Zymar (gatifloxacin; Allergan, Inc., Irvine, CA), because studies have shown less epithelial cytotoxicity with the latter drug.^{3,4} I would have the patient alternate topical Zymar hourly with fortified antibiotics to cover gram-positive infection (vancomycin 50 mg/mL) and gram-negative infection (tobramycin 20 mg/mL) until the culture results were known. A loading dose of each fortified antibiotic every 15 minutes for the first hour should enhance the bacteriocidal effect of each. I would also encourage the patient's frequent use of a preservative-free lubricant such as Genteal Gel (Novartis Ophthalmics Inc., Duluth, GA) or Refresh Liquigel (Allergan, Inc.) as well as soft-gel ice packs over closed eyelids to improve his comfort. Where fortified antibiotics are not immediately available (eg, rural locations), readily available antibiotics such as Polytrim (polymyxin B/trimethoprim sulfate; Allergan, Inc.) combined with Zymar hourly provides both gram-positive coverage (trimethoprim) and gram-negative coverage (polymyxin B) until fortified antibiotics may be obtained.

Prevention is always the best form of treatment. In this case, the bandage contact lens should have been removed on day 3 and the aforementioned antibiotic regimen started simultaneously. Steroids could be added in the future once the infection stabilized so as to prevent further scarring of the cornea.

KARL G. STONECIPHER, MD

Fortunately, this complication of refractive surgery is rare, but its treatment can make the difference between a successful outcome and a poor visual result. First, I want to address the management of the patient as he presents to the clinic. Once the surgeon recognizes that this is most likely a case of bacterial keratitis, treatment should begin immediately with whatever is available after appropriate cultures have been taken. The easiest and most successful culture starts with the contact lens.

I would acquire from the local hospital three tubes of thioglycolate media and place the contact lens in one, a corneal swab of the infected area in the second, and a conjunctival culture in the third. One of my staff members would then return the three cultures to the microbiology department of the hospital. I think waiting on a courier service for pickup wastes precious time. Next, I would stop the Vigamox and the corticosteroid, and I would immediately begin dosing with Zymar 0.3%, gentamicin 0.3%, and Polytrim in the clinic every 30 minutes for the first day or until the fortified antibiotics are available from the compounding pharmacy. Changing the fluoroquinolone can make a difference, and the Ocular TRUST 2 study⁵ demonstrated that gentamicin and Polytrim can be effective against many of the resistant pathogens that are the likely cause of this infection,

including methicillin-resistant *S. Aureus* (MRSA).

Once treatment has begun, it is time to order fortified antibiotics, and most practitioners would start with fortified vancomycin to combat gram-positive infection (especially MRSA). The second choice for gram negatives is usually fortified tobramycin, ceftazidime, or amikacin, depending on the presentation. These agents would be administered every 30 minutes to every hour while awake during the first 24 hours and every 2 to 4 hours while sleeping. Daily follow-up of the patient is indicated until the infection is under control, and dosing of the antibiotics will change based on the patient's response to treatment. Close scrutiny of the cultures and smears from the laboratory is needed, and a change in treatment may be indicated based on those results. Once the infection is under control and the cornea has re-epithelialized, I would restart the corticosteroid to minimize scarring.

I would like to address the cause of the infection. We ophthalmologists cannot control all of the pre- and peri-operative environment, but we can do our best to treat refractive surgery as surgery and minimize exposure. We need to treat dry eye and eyelid margin disease diligently. Moreover, I believe that certain groups of patients require additional postoperative intervention. They include (1) healthcare workers, who are exposed to MRSA and are, in many cases, chronic MRSA carriers, and (2) agricultural workers, who are often exposed to more gram-negative bacteria than the average patient. For both subgroups, I prescribe Polytrim or gentamicin 0.3% eye drops in addition to a fourth-generation antibiotic. Debate over preoperative antibiotics continues, but I have found that having patients start a corticosteroid and fourth-generation antibiotic prior to surgery helps with subclinical eyelid margin disease and dry eyes. This preoperative regimen also allows me to obtain better diagnostic test results on the day of surgery. I will dose patients four times per day for 3 days prior to surgery.

It is when we cut corners that we encounter the complications that we least want to see. The patient in this case, for example, will be a permanent fixture in the surgeon's practice. It is the management of the initial infection that will determine the patient's postoperative outcome in terms of visual rehabilitation.

WALTER J. STARK, MD

The development of a central microbial corneal ulcer after a PRK enhancement is a potentially serious complication, especially if the PRK is performed over a LASIK flap. The infection can spread rapidly, leading to a loss of adhesion and, in severe cases, necrosis of the flap. The complication in this case should be treated as

any other central corneal ulcer—with corneal scrapings for bacterial, fungal, and viral cultures and for smears to direct the treatment until the cultures return.

Although Vigamox is an effective, broad-spectrum antibiotic, for central corneal ulcers, I prefer to start treatment with fortified antibiotics. My regimen is fortified tobramycin and fortified vancomycin alternated every hour when awake and every 1 to 2 hours when asleep for the first 2 to 3 days and adjusted based on culture results and clinical response. The solutions can be prepared as follows. For fortified tobramycin, my colleagues and I inject 2 mL of tobramycin (40 mg/mL) into a 5-mL bottle of tobramycin (0.3% ophthalmic solution). The resulting solution of fortified tobramycin is approximately 15 mg/mL. The bottle should be refrigerated and replaced every 7 to 10 days as needed. For fortified vancomycin, we add sterile water without preservatives to 500 mg of vancomycin powder to form a 10-mL solution. This provides a strength of 50 mg/mL. We reduce that to a concentration of 25 mg/mL by combining 5 mL of the antibiotic solution with 5 mL of sterile water. It should be refrigerated and replaced every 4 to 6 days.

WILLIAM B. TRATTLER, MD

There is a risk of infection following PRK due to the presence of a large epithelial defect and a bandage contact lens. The risk of infection can be higher if the patient does not use prophylactic antibiotic drops as directed or he is given “homemade” dilute anesthetic drops to control pain. After surface ablation, most patients use topical steroids during the healing process, which may also increase their risk for infection.

The 2005 ASCRS survey on post-PRK keratitis noted that gram-positive organisms were the most common cause of these infections.¹ A small percentage of infections, however, were caused by *Nocardia asteroides*, atypical bacteria (mycobacteria), and fungi.

This patient was prescribed moxifloxacin, a fourth-generation fluoroquinolone that is effective against most gram-positive organisms. MRSA infections are becoming more common, however, and occur even among individuals not in the healthcare industry. These organisms can carry resistance to fluoroquinolones. The Ocular TRUST study determined that, of 33 MRSA isolates tested against moxifloxacin, 25 (75.8%) were resistant.⁶ Because gram-positive bacteria are the most common cause of infections after surface ablation, my number-one concern is that the infection in this case is a bacterial keratitis caused by MRSA. Although fungi and atypical bacteria are still on my list of possible diagnoses, the rapid onset of the infection makes them a less likely cause. I would perform a Gram-stain of

corneal scrapings from the infected eye. I would also perform a corneal culture, taken with a calcium-alginate swab, on blood, chocolate, Lowenstein-Jensen, Sabaraud's, and thioglycolate media. In addition, I would culture the bandage contact lens.

If gram-positive cocci in clusters were identified on Gram-stain, MRSA would be my leading diagnosis. I would instruct the patient to stop using the moxifloxacin and loteprednol, and I would initiate therapy with both fortified topical vancomycin and Polytrim eye drops dosed every hour. Both of these agents are highly effective against MRSA.⁶ I would monitor the size of the epithelial defect and wait for the cultures to confirm MRSA as the pathogen. If the epithelial defect and clinical course did not improve over the first 4 to 5 days, I would watch the culture results closely to determine whether a different organism was contributing to the infection. A repeat culture might be necessary if the infection failed to respond as expected.

Once the infection starts to respond to therapy, the next challenges include getting the epithelial defect to close and minimizing the degree of scarring. Some experts prescribe topical steroids to minimize scarring. Because these agents may reduce the effectiveness of the antimicrobial therapy and leave the eye prone to superinfection with other organisms, I favor avoiding them until the epithelial defect is virtually closed.

In all likelihood, this patient will have significant corneal scarring and irregular astigmatism. This situation is extremely challenging for both the patient and the surgeon, who were hoping to fine-tune a visual result and are now left with a serious treatment challenge. If the corneal scarring is superficial, I prefer to perform phototherapeutic keratectomy with mitomycin C 0.02% for 60 to 90 seconds. I would warn the patient, however, to expect a hyperopic shift and irregular astigmatism, and a second procedure would be required to try to address the residual refractive error (assuming there is enough residual corneal tissue for an additional treatment). Of course, if the corneal scarring ends up being too deep, or there is tissue lost to the infection so that there is not enough room for a phototherapeutic keratectomy, I would discuss the possibility of a corneal transplant.

Overall, it is important to remember that infections are an uncommon but serious complication following laser vision correction, especially surface ablation. Steps to speed epithelial healing reduce the risk of infection; they include identifying and treating preexisting dry eye as well as matching the size of the epithelial defect to the size of the laser ablation. This case is a perfect example of why surgeons should only provide dilute topical anesthetics made by a compounding pharmacy. Although not mentioned in the case presentation, if this patient was provid-

ed with dilute anesthetics created in the office by the surgeon or staff, there may be some medicolegal risk, even if the drops were not the source of the infection. ■

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