CORNEAL DYSTROPHIES 101

A brief review for the practitioner most likely to encounter these conditions.

BY STEVEN SORKIN, OD, FSLS

Corneal dystrophies are commonly encountered in the optometric practice. They are a group of hereditary corneal diseases typically classified by the anatomic layer that is affected (Table). The optometrist is frequently the first health care provider to see these patients, and we are well equipped to diagnose and manage these conditions.

Corneal dystrophies are all inherited, bilateral, noninflammatory, nonvascularized, slowly progressive, and unassociated with systemic disease. They are caused by abnormal cellular metabolism and eventually affect the clarity of the cornea. There is an emerging molecular science that will ultimately reconfigure our understanding and classification of these conditions. For now, the basic review provided in this article is intended to supplement any information gaps in your existing knowledge of corneal dystrophies.

AT A GLANCE

- The most common corneal dystrophy is epithelial basement membrane dystrophy.
- Although macular corneal dystrophy is the least common stromal dystrophy, it affects visual acuity most significantly of all the stromal dystrophies.
- Because optometrists are positioned to frequently encounter corneal dystrophies, it is important for them to be able to diagnose, identify, and manage these conditions.

THE DYSTROPHY WITH THREE NAMES

The most common corneal dystrophy is *anterior basement membrane dystrophy*, also known as *epithelial basement membrane dystrophy* (EBMD) or *map-dot-fingerprint dystrophy*. EBMD is bilateral but typically asymmetric, and it exhibits changes to the epithelial basement membrane and abnormal adhesion of the basal cells. Many patients with this condition are asymptomatic. The most common symptoms are a mild foreign body sensation and blurred vision, which is caused by irregular astigmatism and a reduced tear breakup time. Negative fluorescein staining can be observed during slit-lamp examination (Figure 1). EBMD is easy to overlook, but it is critical to diagnose prior to

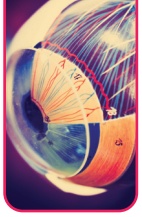


TABLE. SUBDIVISIONS OF CORNEAL DYSTROPHIES

ANTERIOR CORNEAL DYSTROPHIES

Epithelial Membrane Dystrophy
Meesmann Corneal Dystrophy
Lisch Corneal Dystrophy
Reis-Bucklers Corneal Dystrophy
Thiel-Behnke Corneal Dystrophy

STROMAL CORNEAL DYSTROPHIES

Granular Corneal Dystrophy Type 1
Granular Corneal Dystrophy Type 2
Lattice Corneal Dystrophy
Macular Corneal Dystrophy
Schnyder Corneal Dystrophy

POSTERIOR CORNEAL DYSTROPHIES

Fuchs Endothelial Dystrophy
Posterior Polymorphous Dystrophy
Congenital Hereditary Corneal Dystrophy

refractive or cataract surgery because it can affect biometry measurements. Incorrect biometry can cause altered IOL or refractive surgery calculations, which can lead to poor results and unhappy patients.

Approximately 10% of patients with EBMD will experience recurrent corneal erosion (RCE).[1,2] When a patient presents with a corneal abrasion, it is important to examine the contralateral eye, as 50% of patients with RCE will exhibit EBMD in the fellow eye.[3] There are multiple treatment strategies for RCE, including palliative therapy such as drops and ointments (eg, sodium chloride and polyvinyl alcohol and povidone [Freshkote PF, Eyevance Pharmaceuticals]).

Maximizing the health of the ocular surface by aggressively treating eyelid disease is imperative in order to minimize RCE. Lid hygiene, thermal or intense pulsed laser treatment, and nutritional supplementation are also important therapies. Cyclosporine or lifitegrast ophthalmic solution 5% (Xiidra, Novartis) can be used, along with punctal occlusion, to treat concurrent dry eye.

Adding topical steroids and doxycycline for 1 to 2 months to reduce matrix metallopeptidase 9–related surface inflammation can be helpful. Amniotic membranes and long-term use of bandage contact lenses are another approach. Biologics such as Regener-Eyes ophthalmic solution (Regener-Eyes) and autologous serum drops are also used to treat RCE. Options for surgical management include epithelial debridement, diamond burr polishing, anterior stromal puncture, and phototherapeutic keratectomy (PTK).

STROMAL DYSTROPHIES

Other types of corneal dystrophy involve the stroma, the thickest layer of the cornea. Stromal dystrophies include macular, granular (types 1 and 2), lattice, and Schnyder corneal dystrophy.

Macular Corneal Dystrophy

Patients with macular corneal dystrophy present with grayish opacities in the superficial stroma that eventually migrate through to the deeper stromal layers. Although this is the least common stromal dystrophy, it affects visual acuity most significantly of all the stromal dystrophies.

Macular corneal dystrophy is the only autosomal recessive corneal stromal dystrophy and also the only dystrophy that can extend out to the limbus. It can extend even to Descemet membrane, leading to cornea guttata, a poor visual prognosis, and a need for full thickness penetrating keratoplasty (PKP), sometimes as early as the second or third decade of life. In addition to decreased vision, other symptoms include foreign body sensation, photophobia, and discomfort. There is also a high rate of recurrence after PKP.

Granular Corneal Dystrophy

Granular corneal dystrophy type 1 exhibits *breadcrumb deposits* in the stroma that grow, penetrate deeper into the stroma, and increase over time. These deposits are limited to the central cornea. RCE is also common with granular dystrophy. Surgical treatment options include deep anterior lamellar keratoplasty (DALK) and PKP.

Granular dystrophy type 2, also known as granular-lattice or Avellino corneal dystrophy, possesses features of both lattice (see next section) and granular dystrophy (Figure 2). RCE is again a common sequela. This type of dystrophy can be expressed after excimer laser vision correction surgery. AvaGen (Avellino) is a genetic test that can be used to screen patients for the presence of corneal dystrophies and keratoconus before they undergo LASIK.

Lattice Corneal Dystrophy

Lattice corneal dystrophy (Figure 3) manifests as branching refractile lines

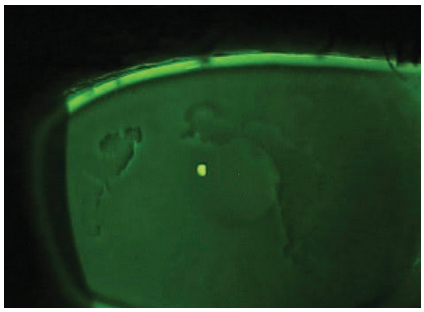


Figure 1. Areas of negative staining seen on slit-lamp examination reveal EBMD.

in the anterior central stroma that thicken and form areas of stromal opacification, affecting visual acuity. The peripheral cornea remains clear, however. Many patients with lattice also experience RCE.

Surgical options include PTK, PKP, and DALK. PTK can remove opacities only from the anterior corneal stroma. Anterior segment OCT can be used to localize and measure the depth of corneal opacities to determine whether PTK is indicated. Typically, 110 µm is the depth limit for PTK treatment; any extension of the dystrophy deeper into the stroma will require corneal transplantation. After a keratoplasty procedure, all stromal dystrophies have a high rate of recurrence in the new graft.[4]

Gas permeable contact lenses can be used to rehabilitate vision. Recently, scleral lenses have become an important part of the treatment algorithm, as they can provide both vision improvement and therapeutic benefits in protecting the corneal surface and reducing the need for corneal transplantation.

Schnyder Corneal Dystrophy

The presence of corneal crystals facilitates the diagnosis of Schnyder corneal dystrophy, but this finding is present in only 54% of those with the condition.[5] Scotopic vision tends to remain good; however, disproportionate loss of photopic vision with complaints of glare have led to the need for PKP in most patients 50 years and older.[6]

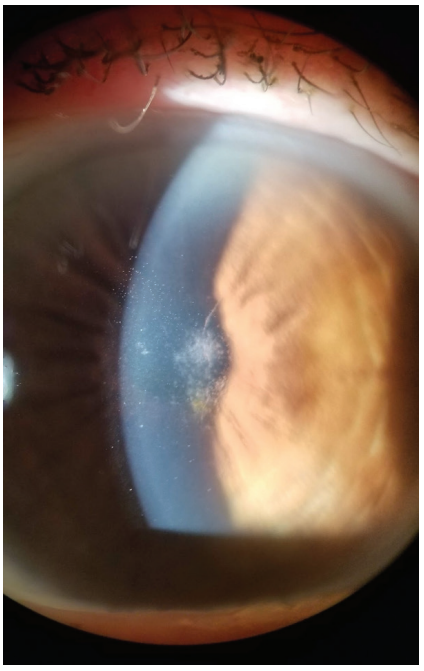


Figure 2. Avellino corneal dystrophy.

ENDOTHELIAL DYSTROPHIES

The furthest posterior corneal layer is the endothelium. It is one cell layer thick, and its pump function helps to maintain corneal transparency. All endothelial dystrophies affect this fluid pump, causing increased hydration of the cornea and eventually leading to edema and loss of corneal clarity. The three most common endothelial corneal dystrophies are Fuchs dystrophy, congenital hereditary endothelial dystrophy (CHED), and posterior polymorphous corneal dystrophy (PPMD).

Fuchs Dystrophy

Fuchs dystrophy is bilateral and autosomal dominant and occurs in women more commonly than men.[7] Cornea guttata is the hallmark finding, in which abnormal endothelial secretions from Descemet membrane form. In addition, the endothelial cells have disrupted morphology, and pleomorphism and polymegathism can be seen on specular microscopy. Patients will frequently complain of blurry vision, particularly in the morning upon awakening. Halos also may affect visual function.

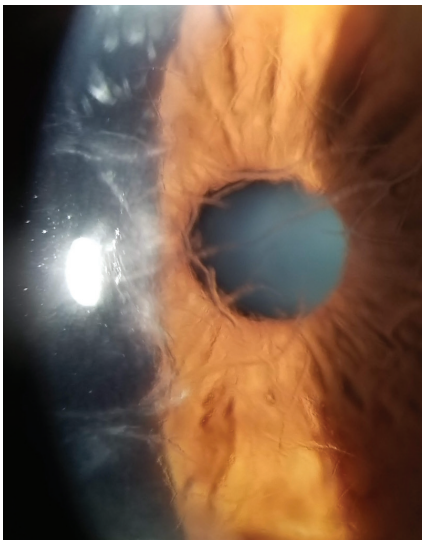
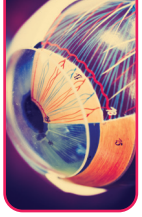


Figure 3. Branching refractile lines in the anterior central stroma of patients with lattice corneal dystrophy, as shown here, affect visual acuity.

Hypertonic ointments and drops may be helpful early on, along with bandage contact lenses to treat epithelial bullae. However, endothelial keratoplasty is indicated if visual function and chronic corneal edema are present. Techniques for endothelial graft have evolved, and Descemet-stripping automated endothelial keratoplasty (DSAEK) and Descemet membrane endothelial keratoplasty (DMEK) are now the preferred approaches over traditional PKP. These lamellar procedures offer a faster recovery, improved visual acuity with less postoperative astigmatism, and less risk of rejection.

A more recently developed technique is *Descemet stripping only* (DSO), also known as descemetorrhexis without endothelial keratoplasty, in which patients with only central guttata can undergo a less invasive procedure without the need of a corneal transplant. A descemetorrhexis is performed, removing the central diseased endothelial cells and leaving the healthy peripheral cells intact. Recovery can take up to 6 months while the endothelial cells migrate to the central area with the assistance of a rho-kinase inhibitor. There is no



need for long-term corticosteroid use and no risk of rejection with DSO.

CHED

CHED has two presentations. Type 1 is inherited as an autosomal dominant trait and is characterized by edema of the cornea, pain, and clear corneas at birth that become cloudy later in infancy. CHED type 2, inherited as an autosomal recessive trait, is more common; it is characterized by corneal edema and cloudy corneas at birth. Nystagmus is also associated with this form of CHED.[7]

PPMD

PPMD is an uncommon corneal dystrophy that can present at birth or later in life. PPMD is typically bilateral, although one eye may be more severely affected than the other. It is characterized by lesions of the endothelium. Most patients are asymptomatic, but in severe cases stromal edema, photophobia, decreased vision, and foreign body sensation have been reported.[8] Glaucoma occurs in 13% of patients with PPMD.[9]

BE READY FOR ANYTHING

Corneal dystrophies are frequently encountered in optometric practice, which is why it is important to be able to diagnose, identify, and manage these conditions. Medical treatment, use of contact lenses when appropriate, and collaborative care with a cornea specialist for surgical intervention may be required. Regular examination of the family members of patients with corneal dystrophies can uncover the inheritance patterns of these conditions. ■

1. Waring GO 3rd, Rodrigues MM, Laibson PR. Corneal dystrophies I. Dystrophies of the epithelium, Bowman's layer, and stroma. *Surv Ophthalmol*. 1978;23:71-122.
2. Kenyon KR, Wagoner MD. Corneal epithelial defects and noninfectious ulceration. In: Albert DM, Jakobiec FA, eds. *Principles and Practice of Ophthalmology*. Vol 2. 2nd ed. WB Saunders; 2000:926-943.
3. Corneal dystrophy, epithelial basement membrane; EBMD. Online Mendelian Inheritance in Man. omim.org/entry/121820. Accessed March 18, 2021.
4. Marcon AS, cohen EJ, Rapuano CJ, Laibson PR. Recurrence of corneal stromal dystrophies after penetrating keratoplasty. *Cornea*. 2003;22(1):19-21.
5. Weiss JS. Schnyder corneal dystrophy. *Curr Opin Ophthalmol*. 2009;20(4):292-298.
6. Weiss JS. Visual morbidity in thirty-four families with Schnyder crystalline corneal dystrophy (an American Ophthalmological Society Society Thesis). *Trans Am Ophthalmol Soc*. 2007;105;616-648.
7. Fuchs dystrophy. MedlinePlus. medlineplus.gov/ency/article/007295.htm. Accessed March 8, 2021.
8. Corneal dystrophies. National Organization for Rare Disorders. rarediseases.org/rare-diseases/corneal-dystrophies/. Accessed March 8, 2021.
9. Cibis GW, Krachmer JA, Phelps CD, Weingeist TA. The clinical spectrum of posterior polymorphous dystrophy. *Arch Ophthalmol*. 1977;95(9):1529-1537.

STEVEN SORKIN, OD, FSLS

- Director, Contact Lens Services, Corneal Associates of New Jersey, Fairfield, New Jersey
- President, Essex County Optometric Society
- ssorkin@cornealassociates.com
- Financial disclosures: Speaker/Consultant (Bausch Specialty Vision Products, Blanchard Contact Lenses, Boston Sight, Dompe, Eyevance Pharmaceuticals, Sight Science, Synergeyes, Visioneering Technologies); Medical Advisory Board (International Keratoconus Academy); Editorial Board (Journal of Dry Eye and Ocular Surface Disease)