

CLINICAL CASE

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Terrien's Marginal Degeneration Accompanied by Latticed Stromal Opacities

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ABSTRACT

Purpose. We report a case of Terrien's marginal degeneration (TMD) with a unilaterally typical narrow band of peripheral corneal stroma thinning, accompanied by the presence of an unusual network of opacities diffusing throughout the anterior stroma layers.

Case Report. A 43-year-old woman presented with superior nasal peripheral corneal thinning and an unusual network of polygonal stromal opacities in the anterior corneal stroma of the right eye. Latticed corneal changes were unusually extensive and distributed diffusely in the stroma. No abnormalities were found in the corneal epithelium and in the basal epithelial cells. No noticeable changes were found in the left eye. Because of a progressively worse ocular irritation of the right eye, a diagnosis of TMD was made for this patient.

Conclusions. This case of TMD accompanied by keratopathy was unusual. The branching stromal lattice pattern of the corneal opacities was difficult to distinguish from lattice corneal dystrophy. In this case, the polygonal stromal opacities were located in the anterior corneal stroma and therefore were distinguished from a similar manifestation in posterior crocodile shagreen.

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Key Words: Terrien's marginal degeneration, stromal opacity, keratopathy

Terrien's marginal degeneration (TMD) is a rare, slowly progressive disorder of the peripheral cornea in which the outer perimeter of the limbus presents with a shallow groove, neovascularization, stromal opacities, thinning, and ectasia.¹ The condition was first described in 1990 by Terrien² as a marginal, asymmetric, and ectatic corneal atrophy. As the disease progresses, severe peripheral corneal thinning and perforation often lead to various degrees of astigmatism. Neither spectacles nor contact lenses can correct extreme astigmatism; hence, keratoplasty is currently the only therapeutic approach.³

Herein, we report a case of TMD in a 43-year-old woman who presented with a typical narrow band of peripheral unilateral corneal thinning, accompanied by an unusual network of stromal opacities in the anterior portion of the rest of the cornea.

CASE REPORT

A 43-year-old woman complained of irritation in the right eye, which had started 5 months previously and had progressively become worse. She was otherwise healthy and had no history of ocular trauma or surgery. Her best-corrected visual acuity was 6/7.5 in the right eye and 6/10 in the left eye. Keratometric values in the right eye were 46.8 diopters (D) at 126 degrees and 42.8 D at 36 degrees and those in the left eye were 45.1 D at 90 degrees and 43.7 D at 180 degrees. Anterior segment slit lamp examination showed superonasal peripheral corneal thinning in the right eye, with a narrow clear band of corneal thinning that is typical of TMD, approximately 2 mm in width, which extended from the 12-o'clock to the 2-o'clock position. The thinning cornea had led to as much as 50% stromal tissue loss. There was a 1- to 2-mm-wide uninvolved region located between the thinned bandlike region and the limbus. The thickness of the cornea on both sides of the thinned bandlike region was normal, as observed with a slit beam. There was intact epithelium of the thinning zone with corneal bulging. We also observed superficial neovascularization originating from the limbus in the thinning cornea. An unusual network of polygonal stromal opacities was found in the anterior corneal stroma. The latticed corneal changes, viewed with

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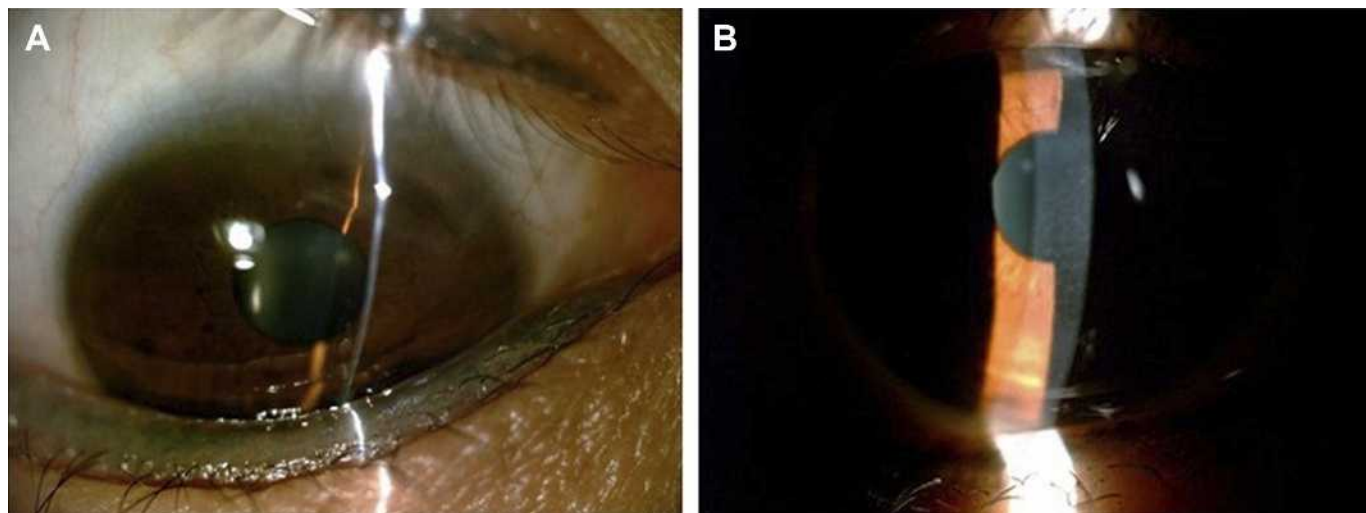


FIGURE 1.

Anterior segment of the right eye under slit lamp. (A) A narrow and clear band of corneal thinning, typical of TMD, was 2 mm in width and extended from the 12-o'clock position to the 2-o'clock position. (B) Honeycomb pattern of polygonal stromal opacities was found in the rest of the cornea. The distribution of the corneal opacities was asymmetric.

a slit beam, were unusually extensive and in various positions in the stroma, distributed diffusely from the basement membrane to the anterior corneal stroma, and demarcated from the surrounding clear corneal stroma. The lower end of the latticed opacities extended into the midstroma. The conjunctiva was quiet, and there was no discharge (Fig. 1). The anterior chamber appeared deep owing to forward bulging of the superonasal peripheral cornea,

although this was not measured quantitatively. The lens and iris were normal, with no signs of current or previous inflammation. A fundus examination was unremarkable. No obvious abnormality was found in the left eye.

Anterior segment optical coherence tomography (Visante; Carl Zeiss Meditec, Dublin, CA) scans clearly showed thinning in the superonasal peripheral cornea of the right eye. The thickness at the

Image Analysis Report



Rx: Sphere: 0.0
 Cylinder: 0.0
 Axis: 0.0
 Fixation Angle: 0.0
 Polarization: 23.0
 Orientation: 20.0



OD

Visante™ OCT
 ANTERIOR SEGMENT IMAGING

Exam date: 10/18/2011 9:36:24 AM Protocol: All Scans Scan: Anterior Segment Dual

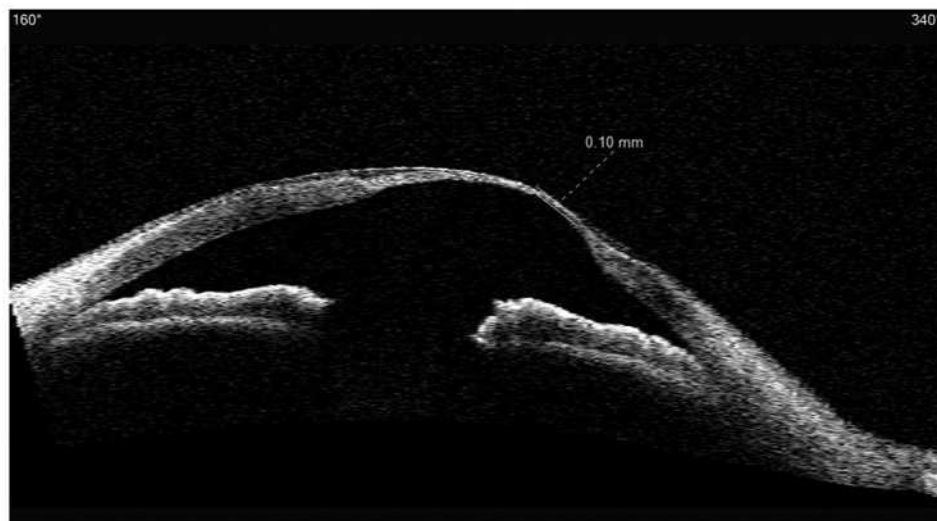


FIGURE 2.

Anterior segment Visante optical coherence tomography scanning of the right eye in this TMD patient showed that the thickness at the thinnest portion of the cornea was 0.1 mm.

thinnest area of the stroma was only 0.1 mm (Fig. 2). Orbscan II corneal topography of the right eye showed moderately irregular astigmatism resulting from TMD, according to a semiquantitative classification of the regularity of keratometry mires as published earlier (0, regular; 1, mildly irregular; 2, moderately irregular; 3, unmeasurable).⁴ Corneal map Diff values were 0.044 and 0.164 anterior and posterior, respectively. Simulated keratometry was 46.8/42.8 D at 36 degrees (-4.00 D of astigmatism). Mean corneal irregularities were 4.5 and 7.3 D in the 3.0- and 5.0-mm zones, respectively. The corneal thinnest point was 293 μm in the superonasal quadrant (Fig. 3).

Corneal confocal microscopy in the thinning lesion area of the superonasal peripheral cornea revealed normal-appearing epithelial layers, the irregularity of the Bowman membrane, and stroma-activated keratocytes (Fig. 4). The subbasal nerve plexus showed decreased nerve fiber density in the right eye relative to the left eye and deposition of a nonhomogeneous hyperreflective material across the basal epithelium and the anterior stroma in the thinning lesion area. Prominent gray polygonal opacities separated by thin clear spaces were spread diffusely over the entire cornea, located in the anterior stromal layer immediately anterior to the posterior stromal layer. Latticed opacification of irregular intensity with intermittent linear clear cracklike zones throughout various planes

of the anterior stromal layer was observed. The lower end of the polygonal opacities extended into the midstroma. Nerve fibers were enlarged. No abnormalities were detected in the corneal epithelium. The morphology of the basal epithelial cells had no detectable abnormalities. Both the posterior stromal layer and the corneal endothelium were normal.

A diagnosis of TMD with corneal stromal degeneration was therefore made, and the clinical stage was the third stage of TMD.

After obtaining written informed consent from the patient and surgical approval from the Ethics Committee of the First Hospital of Jilin University, deep anterior lamellar keratoplasty (DALK) was successfully performed, with removal of the corneal stroma and transplantation of a donor button in the right eye of this TMD patient. The donor corneal buttons used for DALK grafting were obtained from whole donor eyes preserved in the eye bank of our hospital. To perform lamellar dissection and expose the Descemet membrane, we separated the corneal lesion from the 11-o'clock position to the 3-o'clock position; the transverse and vertical diameters were 7.0 and 2.5 mm, respectively. After a donor corneal button of the same size as the removed endodermis was transferred, the crescentic donor corneal button was sutured into the recipient bed using 10-0 nylon interrupted sutures. The graft was attached well to the recipient cornea.

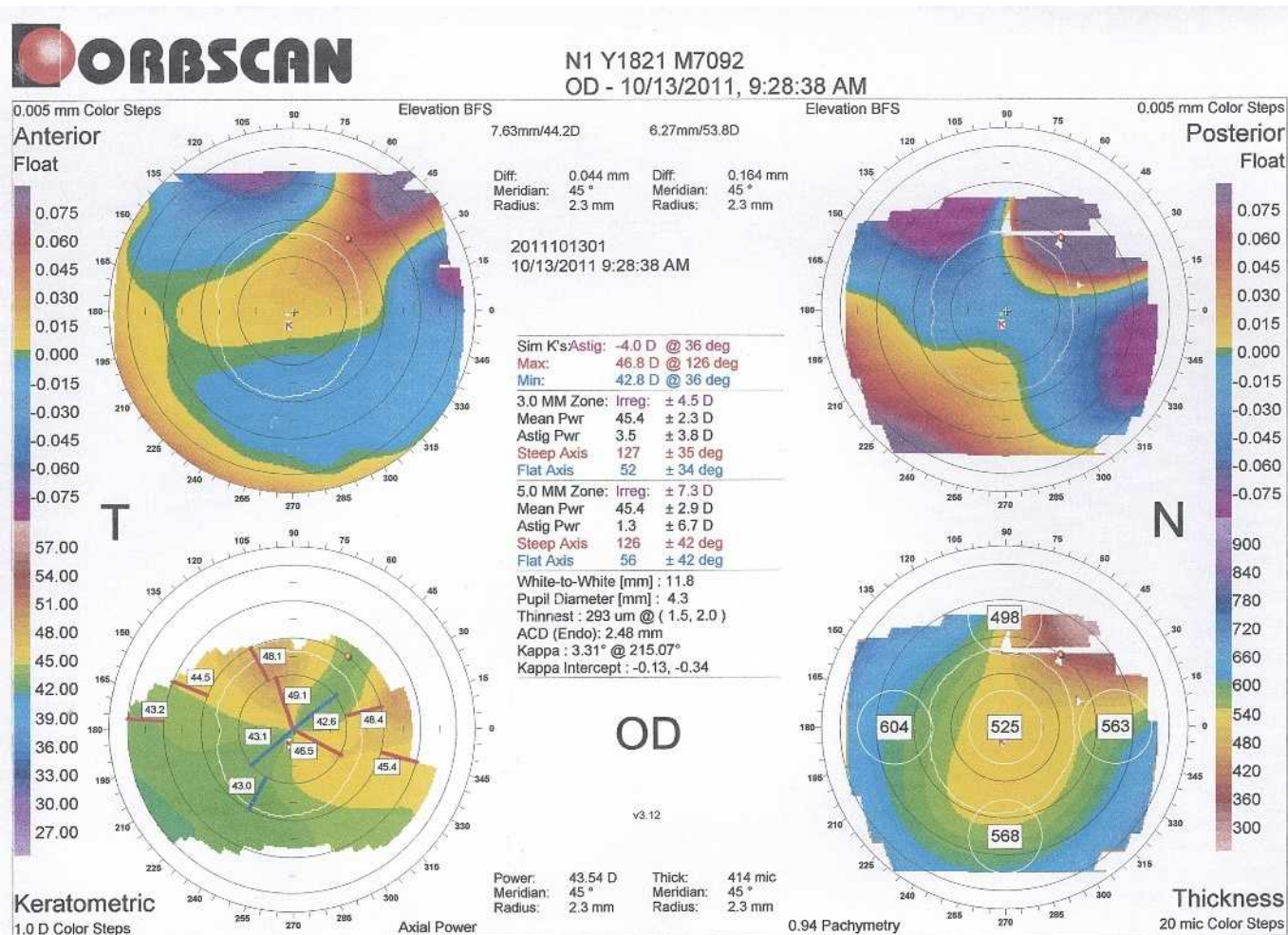


FIGURE 3. Orbscan II corneal topography of the right eye showed localized thinning in the superonasal quadrant and irregular astigmatism resulting from TMD.

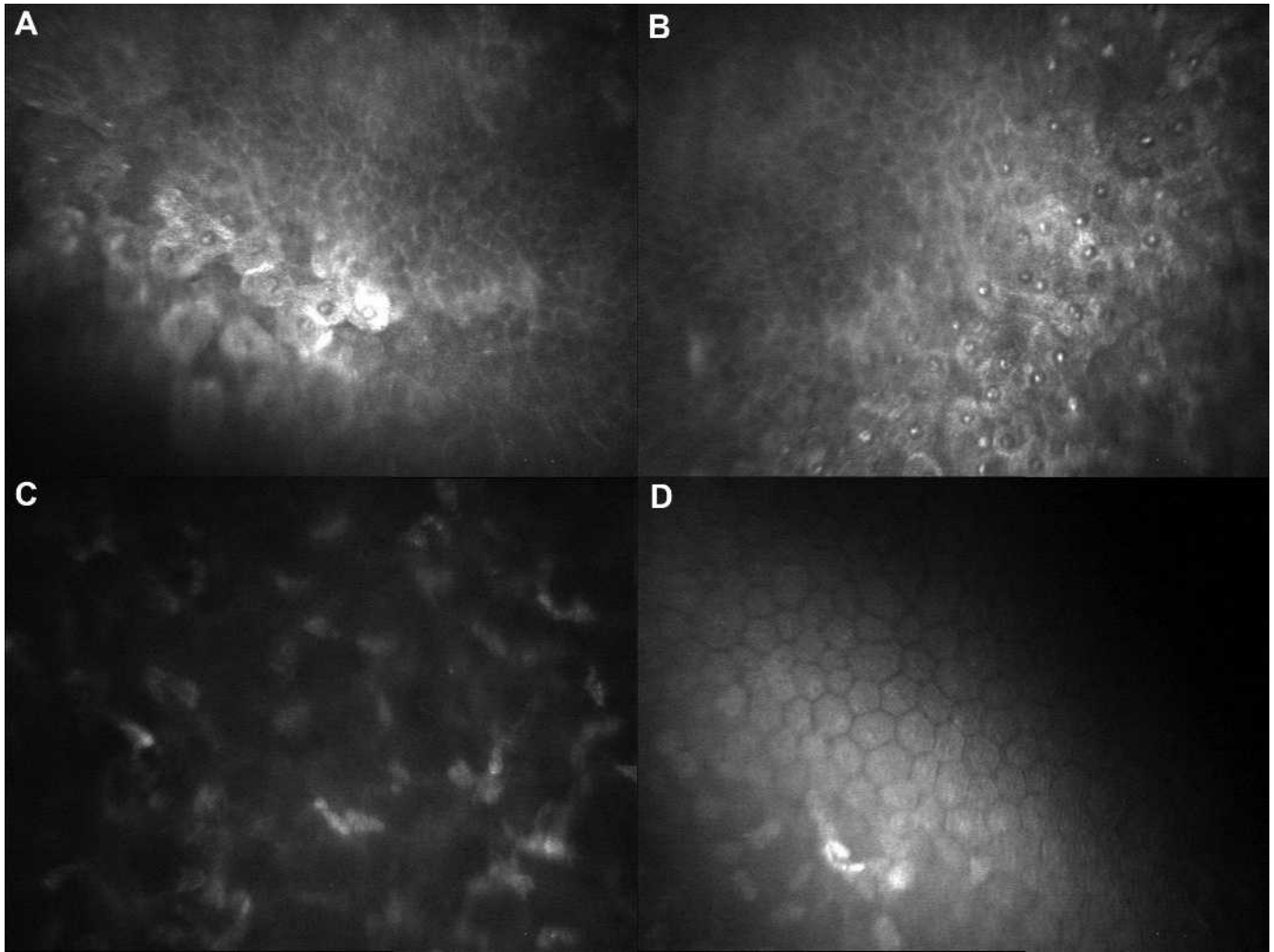


FIGURE 4.

Corneal confocal microscopy of the right eye showed that (A and B) the gray polygonal corneal opacities were separated by thin clear spaces in the anterior corneal stroma, to the basement; (C) the posterior stromal layer was normal; (D) no abnormalities were detected in the corneal endothelium.

Histology of the corneal lesions showed that the corneal epithelium was thick and the stromal tissue was lost. We observed corneal blood vessels surrounding inflammatory cells at the level of the paralimbar conjunctiva and in the peripheral cornea (Fig. 5).

Postoperatively, the patient was treated for conventional lamellar keratoplasty. A 2-year follow-up of this patient showed that stable visual acuity was maintained and no further specific treatment was needed. The sutures were removed 18 months after lamellar keratoplasty. The corneal graft remained transparent. The anterior segment evaluation by slit lamp showed no obvious change in the lattice lesions in the corneal stroma (Fig. 6). The postoperative best-corrected visual acuity was 6/6 in the right eye and 6/10 in the left eye at 2 years. Keratometric values in the right eye were 45.0 D at 134.9 degrees and 41.7 D at 44.9 degrees. The corneal thinnest point was 514 μm postoperatively. Follow-up and a subsequent investigation into this peculiar case have continued. With informed consent, we obtained the medical histories of seven family members (four male and three female subjects), five of whom are still living (two male and three female subjects, including her mother, two of her brothers, and her older sister; although she had been married for many years, she had no children). Slit lamp and

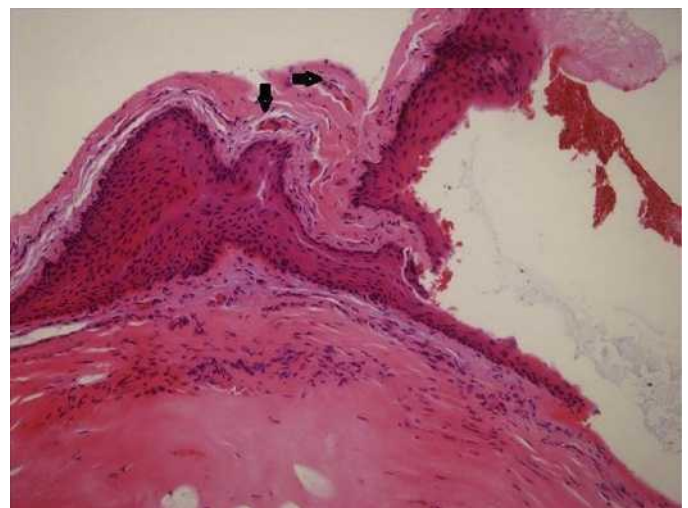


FIGURE 5.

A histological section of the corneal lesion showed that the corneal epithelium was thick and stromal tissue was lost. There were corneal blood vessels surrounding inflammatory cells at the level of the paralimbar conjunctiva and in the peripheral cornea.

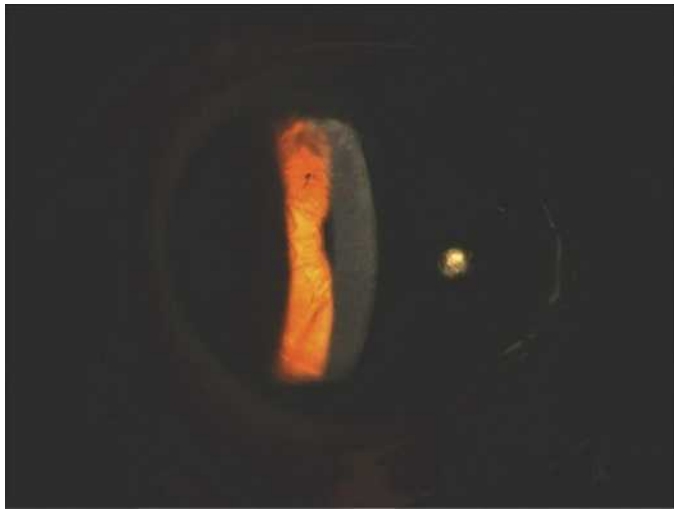


FIGURE 6.

Anterior segment evaluation by slit lamp at the 2-year follow-up showed no obvious change in the lattice lesions in the corneal stroma.

dilated fundal examination showed that the corneas of the patient's family members were completely normal, without any evident corneal opacity.

DISCUSSION

Terrien's marginal degeneration is usually a bilateral degenerative corneal disorder, except as described in a few isolated case reports of unilateral involvement.⁵ Examination of corneal topography is useful in establishing the diagnosis of TMD because corneal topography mapping can provide valuable information on the corneal curvature and magnitude and direction of astigmatism.⁶ A confirmed diagnosis of TMD is usually made based on corneal topography and a careful slit lamp examination.⁷

The first symptom for most TMD patients is poor visual acuity caused by irregular astigmatism without ocular irritation. However, a variant with episodic inflammation in younger patients has been described, and recurrent, episodic, disabling inflammation is an infrequent feature.⁸ Clinicians usually divide TMD into five stages in its development and progression. In the first stage, the upper part of the peripheral cornea slowly narrows and then dilates. In the second stage, a sharp yellowish-white border that contains lipid deposits forms a leading edge between the narrowed and normal corneal portions. In the third stage, the lesion becomes increasingly thinner with remarkably irregular astigmatism. In the fourth stage, keratoconus forms. With the progression of this disease, several complications may occur in the fifth stage, such as spontaneous or traumatic perforation of the cornea because of thinning. For patients in the second stage, contact lenses may be considered. For those already in the third, fourth, or fifth stages, surgery is the only treatment of choice.^{9–11}

Lamellar keratoplasty is currently the most advocated surgery for visual rehabilitation in TMD patients. The primary objective of keratoplasty is to restore corneal surface topography, thereby reducing refractive error and improving visual acuity. The efficacy of the corneal graft is ultimately determined by the improvement in the quality of life and functional vision of the patient.¹² It is

important that the graft be the same size as the removed degenerative corneal area to recover normal corneal curvature.

To the best of our knowledge, this is the first TMD case with branching stromal lattice figures with opacities reported in the literature. However, it is somewhat difficult to distinguish between the branching stromal lattice figures of keratopathy and that of lattice corneal dystrophy (LCD) on the basis of ocular manifestation. Also, this manifestation in our case is similar to posterior crocodile shagreen (Vogt),¹³ basing our judgment on a review of published figures.^{14,15} As a result, we had to differentiate among keratopathy with branching stromal lattice figures, LCD, and posterior crocodile shagreen before the correct diagnosis could be made.

Posterior crocodile shagreen, a degenerative disorder mainly found in elderly individuals, was first described by Weizenblatt in 1927 and subsequently named by Vogt¹⁶ in 1930. To date, little more is known about this disease. It is characterized by grayish-white polygonal opacities with indistinct edges and intervening clear zones involving the posterior corneal stroma, concentrating various planes of the posterior stromal layer, but sparing the corneal epithelium and endothelium. The name posterior crocodile shagreen is attributed to the location of the opacities and the resemblance of their pattern to crocodile skin. Transmission electron microscopy revealed distinctive sawtooth-like configurations of the stromal collagen lamellae, and histological findings of polymorphic amyloid degeneration have also been reported in some cases.^{14,15} Posterior crocodile shagreen also shares a similar clinical appearance with central cloudy dystrophy of Francois. It is believed that neither condition can cause significant visual loss. The distinction between these entities mainly exists in the inheritance pattern, and central cloudy dystrophy of Francois has been reported in patients as young as 8 years. Although the polygonal stromal opacities in the present case were somewhat similar to posterior crocodile shagreen, the corneal opacities of our case were located in the anterior but not in the posterior corneal stroma.^{17,18} Thus, we could distinguish our case of branching stromal lattice figure keratopathy from posterior crocodile shagreen.

Lattice corneal dystrophy is a subtype of a vast group of corneal dystrophies.¹⁹ Corneal dystrophies including LCD are typically bilateral and symmetric.^{20–23} The left eye of this case was asymptomatic and appeared to be normal, without deposits or opacities. To investigate the unilaterality of this corneal disorder in more detail, we performed *in vivo* confocal microscopy detection bilaterally. No highly reflective deposits or lattice-shaped material seen in the right cornea was identified in the entire left cornea. These findings indicated the complete unilaterality of this corneal disorder based on confocal microscopy. Unilateral LCD is very rare but was first reported by Netchaiewa²⁴ in 1937. Lattice lesions may develop in the other eye many years later, and this should be explained to all patients with apparent unilateral LCD. Based on these references and case reports, we concluded that unilateral LCD can occur in two clinical types. The first type occurs mainly in early life (third and fourth decades), and visual acuity is impaired severely enough to warrant keratoplasty. The second type occurs predominantly in late life in men, who usually present with minimal symptoms and good visual acuity.^{24–26}

Actually, it is difficult to distinguish the present case from lattice dystrophy. First, the morphological feature and distribution of the

lattice lines in our patient were similar to the clinical characteristics of LCD, not only by slit lamp but also by *in vivo* confocal microscopy. No abnormalities were detected in the corneal epithelium. Both the posterior stromal layer and the corneal endothelium were normal. Second, the histopathology of LCD reveals eosinophilic deposits present in the Bowman layer and the stroma by hematoxylin-eosin stain. However, there were no amorphous eosinophilic deposits in stroma layers of the present case. The excised corneal button was only a superonasal peripheral part of the whole cornea, and the stromal tissue was lost because of TMD. Therefore, we were not able to harvest enough recipient tissue with partial DALK to find lattice formations. Third, the patient of this study was indeed biologically related to the other family members and not adopted. There was no family history of ocular disorders, and the examination of other family members was unremarkable. Diagnosing unilateral corneal dystrophy usually becomes more difficult, as in this case, without a family history of corneal dystrophy. Lattice corneal dystrophy type III sometimes occurs unilaterally and is considered inherited, with an autosomal recessive pattern. One possibility is that our patient may have an autosomal recessive inheritance or a rather sporadic expression. The patient was a middle-aged woman, with a best-corrected visual acuity of 6/7.5 preoperatively, which improved to 6/6 postoperatively. More importantly, there was no obvious change in the lattice lesions observed at a 2-year follow-up. It may be that the same pattern of corneal opacity with lattice lines may occur in the left eye of this patient in the future.

It is possible that the corneal changes described herein show that TMD is related in some way to lattice dystrophy; alternatively, this may simply be a case of concomitant LCD in a patient with TMD. Recent studies based on molecular analysis revealed that corneal stromal dystrophies of LCD types I and IIIA are caused by point mutations in the transforming growth factor β -induced (*TGFBI*) gene, which encodes for keratoepithelin, and mutated keratoepithelin protein is believed to be amyloidogenic in stroma.²⁷

Terrien's marginal degeneration is characterized as a degenerative disorder because of its slow progression and relatively late onset. Although the etiology of this entity remains unknown, it has been reported that TMD was associated with some autoimmune diseases.²⁸ Zarei-Ghanavati et al.²⁹ reported an interesting case of bilateral TMD-like corneal ectasia and posterior polymorphous corneal dystrophy in a young man with quiescent rheumatoid arthritis. Actually, the woman in the present study was healthy and had no autoimmune diseases. As a result, considering all of the abovementioned facts, we consider that the marked peripheral corneal thinning in our case is independent corneal degeneration and not related to any corneal dystrophy.

Corneal degenerative diseases comprise a range of disorders involving either primary diseases or secondary iatrogenic conditions, including band-shaped keratopathy, marginal degeneration, and lipid degeneration.³⁰ These diseases have various effects on visual acuity, but there are few reports of rare or subtle corneal features that could provide valuable insights^{31–34} into pathogenesis. Our case was characterized by a typical narrow band of peripheral corneal stroma thinning unilaterally, accompanied by lattice opacities diffusing throughout the anterior stromal layers. We propose that the two conditions, sporadic LCD and TMD, existed together but were not related. The clinical findings in this case indicate that the etiology and pathogenesis of corneal degeneration

need further clarification. It is important to report such rare corneal abnormalities.

CONCLUSIONS

This case is very rare, and a misdiagnosis may easily be made. We suggest that the diagnostic possibility of TMD should be considered whenever a patient presents with the typical narrow band of peripheral corneal stroma thinning unilaterally, accompanied by an unusual network of opacities diffusing throughout the anterior stromal layers.

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