

Use of HR-OCT to Distinguish Between Inflammatory and Non-inflammatory Causes of Peripheral Corneal Thinning

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Abstract

Purpose: To evaluate the ability of anterior segment high resolution optical coherence tomography (HR-OCT) to distinguish inflammatory vs. non-inflammatory causes of peripheral corneal thinning.

Methods: Retrospective chart review of nine patients with peripheral corneal thinning. Analysis of HR-OCT images and correlations with slit lamp photos and clinical history.

Results: The HR-OCT images of 4 patients with non-inflammatory peripheral corneal thinning, and 5 patients with thinning in the setting of clinical signs of inflammation (pain, bulbar hyperemia, systemic auto-immune disease) were analyzed. On HR-OCT, a band of intense hyporeflectivity was consistently seen under the area of thinning in eyes with clinical features of inflammation whereas this finding was absent in patients with thinning-unrelated inflammation.

Conclusion: In our small, pilot study, a band of hyporeflectivity under the area of thinning was seen in patients with inflammatory but not degenerative peripheral thinning. Further studies are needed to evaluate the utility of HR-OCT in the diagnostic approach of peripheral corneal thinning.

Introduction

- The peripheral cornea is anatomically and physiologically distinct from the central cornea
 - ✓ The peripheral cornea is thicker¹
 - ✓ The peripheral cornea is near lymphatics, blood vessels, and inflammatory cells^{2,3} and is thus more vulnerable to injury from autoimmune conditions
- Differentiating inflammatory diseases such as peripheral ulcerative keratitis (PUK) from degenerative conditions like Terrien's marginal degeneration (TMD) has classically relied on slit lamp biomicroscopy

When slit-lamp biomicroscopy is not enough

- Some patients present with peripheral thinning of unknown etiology
- The patient's history may be unreliable, and the peripheral thinning may not fit a known reliable disease pattern
- Could other tools help guide the diagnosis and treatment of these patients?

Can HR-OCT be useful for distinguishing inflammatory vs. non-inflammatory causes of peripheral corneal thinning?

- HR-OCT has been used to diagnose and monitor ocular surface squamous neoplasia (OSSN)⁹, help plan refractive and cornea surgeries¹⁰, and diagnose post surgical complications¹⁰
- Prior studies have demonstrated the ability of HR-OCT to detect morphologic changes in areas of thinning not apparent by clinical exam¹¹
- **In this study, our aim was to evaluate whether HR-OCT could help differentiate between inflammatory versus degenerative peripheral corneal thinning**

Study Participants

- 9 patients with peripheral corneal thinning noted on exam underwent imaging with HR-OCT
- Mean patient age was 57.5 years
- 4 patients had a history of indolent peripheral thinning, not associated with pain, redness or photophobia. None of these patients had a history of autoimmune disorders
- 5 patients had a history of thinning associated with periods of inflammation. Of those, 2 patients suffered from rheumatoid arthritis (RA) and one of them from scleritis

	Patient	Age/ Gender	Eye(s) involved/ Location	Systemic co- morbidities	Therapy at time of imaging	Prior therapy
Non-inflammatory thinning	1	81/WM	OU/ 270 degrees 11-9 o'clock	None	AT	none
	2	67/WM	OU/ inferior	None	AT	none
	3	31/WF	OD/ superior	None	AT	none
	4	73/WM	OD/ superior	None	AT	olopatadine
Inflammation-mediated thinning	5	27/WHM	OU/ inferior	None	Topical corticosteroid	none
	6	68/WM	OU/ inferior	None	Topical cyclosporine	AT
	7	69/WM	OD/ inferior	Rheumatoid arthritis	AT Topical cyclosporine Autologous serum tears Minocycline Tofacitinib	none
	8	59/WF	OD/ inferior	Rheumatoid arthritis	AT Topical corticosteroid Autologous serum tears Omega 3	Topical cyclosporine Oral doxycycline
	9	43/BF	OS/ superior	Periocular dermatitis/ scleritis	AT Topical cyclosporine and corticosteroid Naproxen	none

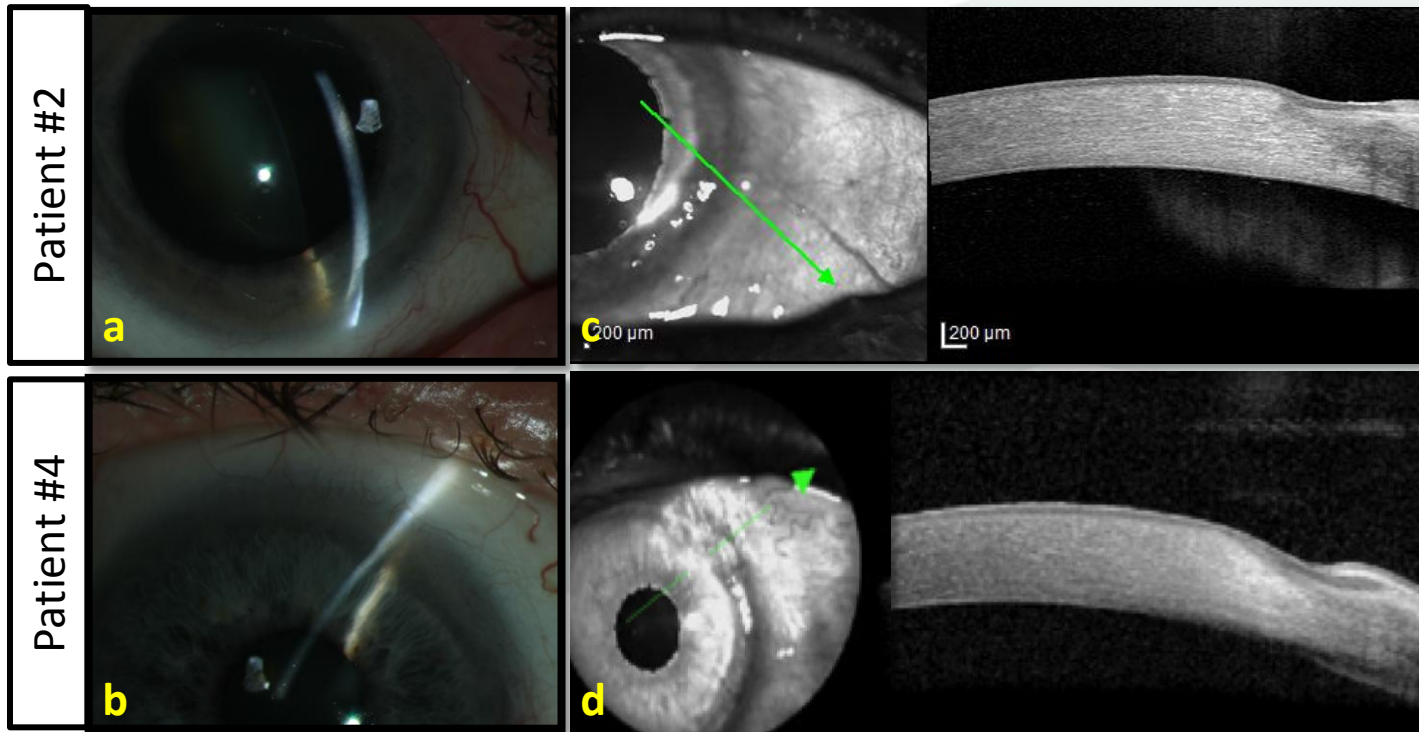


Figure 1. Non-inflammatory peripheral corneal thinning

Fig 1a, 1b- Representative slit lamp photos from patients without clinical or historical evidence of inflammation showing a white and quiet conjunctiva, normal epithelium but thinning of the peripheral cornea.

Fig 1c, 1d- HR-OCT images from the same patients showing an intact epithelium, varying degrees of stromal tissue loss, with minimal changes in the reflectivity of the stroma in the area of thinning. Figures 1d demonstrate marsupialization in the setting of tissue loss.

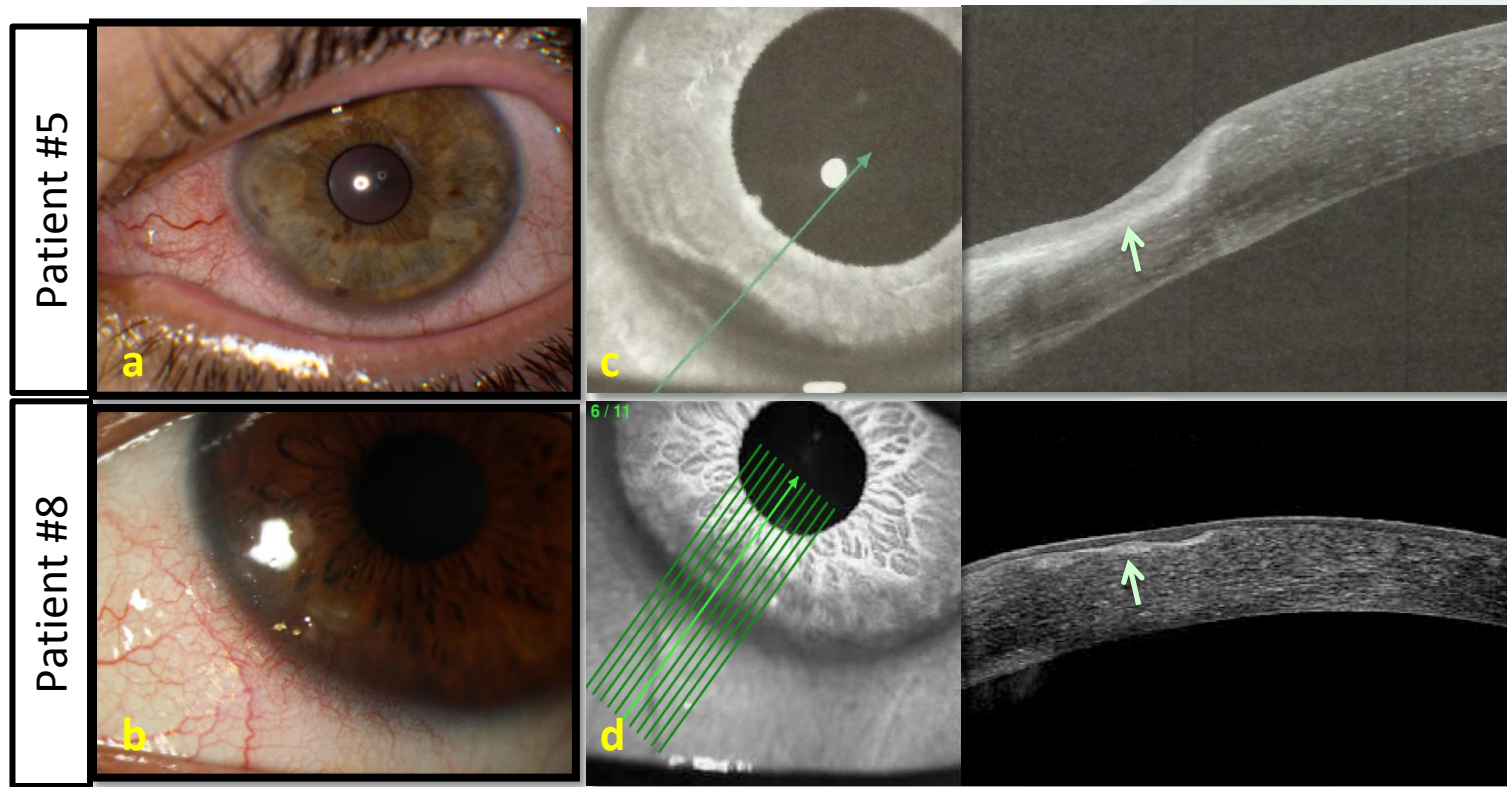


Figure 2. Peripheral corneal thinning associated with inflammation

Fig 2a, 2b- Representative slit lamp photographs of the external eye of two patients with active inflammation (patient #5) or prior history of inflammation leading to thinning of the peripheral cornea (patient #8).

Fig 2c, 2d- HR-OCT of the same patients demonstrating moderate, more broad based corneal thinning, with an intact epithelium and a hyperelective band (arrow) in the stroma, directly under the area of thinning. No evidence of marsupialization or cavity formation is detected in any of these patients.

Conclusions

- In patients with a history of inflammation-related peripheral corneal thinning, we found a hyperelective band under the area of thinning in HR-OCT
- Patients with a history of peripheral corneal thinning unrelated to inflammation did not demonstrate this area of hyperelectivity. Instead, they exhibited various stromal changes, such as cavity formation and marsupialization, which were not seen in the setting of inflammation
- Although the number of patients in our study is small, we postulate that HR-OCT may be a useful tool in differentiating inflammatory versus degenerative peripheral corneal thinning

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