

Optical Coherence Tomography as a Diagnostic Adjunct for Ocular Surface Lesions

Mihika Dube¹, Brijesh Takkar¹, Payal Gupta¹, Anubha Rathi², Saroj Gupta¹, Bhavana Sharma¹

¹Department of Ophthalmology, All India Institute of Medical Sciences, Saket Nagar, Bhopal, India

²Department of Ophthalmology, Dr RP Centre for Ophthalmic Sciences, AIIMS, New Delhi, India

Abstract

We describe a series of four cases with ocular surface lesions, where optical coherence tomography (OCT) proved to be a useful tool for diagnosis and/or management. These cases included pterygium with cyst, suspected ocular surface squamous neoplasia, nodular scleritis and an inclusion cyst. The ability of OCT to reveal the internal characteristics and the true location of lesion may help, in judicious decisions regarding excisional biopsy in future.

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Introduction

A large variety of lesions are known to affect the ocular surface.^{1,2} There may be overlapping clinical signs and varied presentations of different entities, leading to diagnostic dilemmas. Knowledge of the internal structure of such lesions which are otherwise oblivious to the examiner's eye may therefore be very helpful in such situations.^{1,3} We present 4 cases where optical coherence tomography (OCT) proved useful in making the diagnosis and guiding management of such surface lesions.

Case Series

Case 1: A 32 yrs-old man presented with a slow growing mass encroaching over surface of the right eye (RE) since one year. On ocular examination, best-corrected visual acuity (BCVA) was 6/6 in RE and 6/9 in left eye. A flat triangular wing shaped lesion was noted on the medial side of the RE limbus, along with a raised translucent mass (5mm in its longest dimension) arising within it (Figure 1). We suspected pterygium with cystic degeneration in the RE. OCT revealed the lesion to be arising from the sub-epithelial region of the medial conjunctiva and encroaching over the limbus (Figure 1). Further, it was noticed that a deeper well-defined cystic lesion was seen arising from the deep episcleral or superficial sclera tissue. The cyst appeared to contain ill-defined hypo-reflective material, and we could not see the scleral side of the image due to poor penetration of the lesion or optical shadowing. We performed pterygium excision with conjunctival auto-graft and excisional biopsy of the cyst. Histopathology confirmed the clinical suspicion. Routine post-operative care was advised.

Case 2: A 50 yrs-old female presented with a mass over the medial aspect of LE since 6 months, referred with a clinical diagnosis of ocular surface squamous neoplasia. BCVA was 6/6 in both eyes (BE). A yellowish-white swelling with smooth overlying epithelium was seen that measured 2-3 mm in its basal diameter and 1-2 mm in height (Figure 2). No feeder vessels seen. OCT revealed a well-demarcated sub-epithelial lesion with homogenous internal structure involving the conjunctival stroma, which stopped well before the limbus and had normal overlying epithelium (Figure 2). Further,

a clear line of separation was obvious between the lesion and the tissue, suspecting pinguecula. Impression cytology did not reveal any dysplastic cells. Excisional biopsy was planned, but she opted for follow up and the lesion has remained stable until 4 months of follow up.

Case 3: A 34 yrs. old female presented with acute red eye and a swelling in RE since 4 days. On ocular examination, her BCVA was 6/6 in both eyes. A solitary raised nodular lesion was noted over the temporal ocular surface with severe congestion of conjunctival and deep episcleral/scleral vessels, suggesting nodular scleritis (Figure 3). OCT

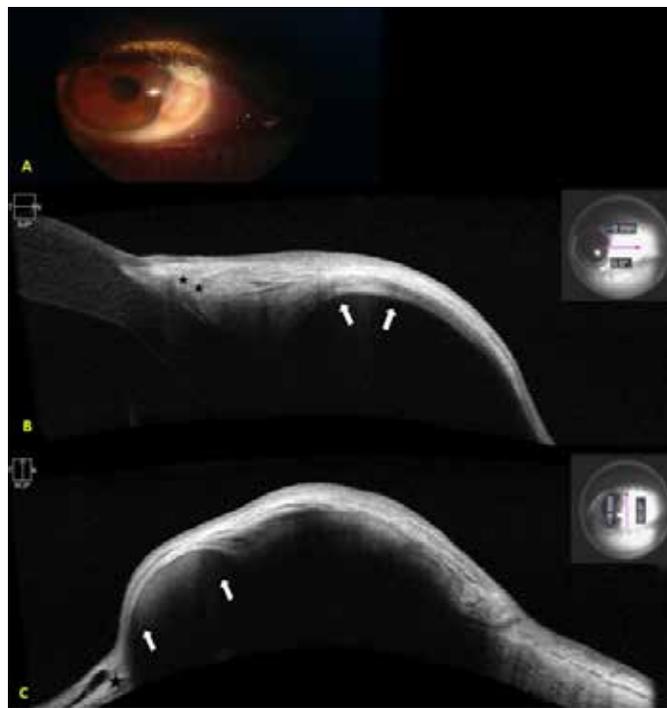


Figure 1A: Clinical photograph of affected eye showing pterygium with cyst.

Figure 1B: Horizontal HD OCT scan at the middle limbus showing a wedge shaped stromal lesion encroaching into the corneal stroma (black asterisk). A deeper cystic lesion is also seen (white arrows)

Figure 1C: Vertical scan through the lesion reveals it to be filled with hypo reflective structure (black arrows). Overlying vessels can be seen (white asterisk)

images showed an ill-defined swelling in the deep episcleral/sclera tissue with extracellular fluid in the conjunctival stroma as well as deeper tissues. Clinical examination and OCT were then repeated after blanching with 10% topical phenylephrine. The conjunctival and episcleral fluid had disappeared, but the deeper fluid persisted on OCT. The swelling had also become more distinct, though not as much as in case 2, which strengthened the clinical diagnosis

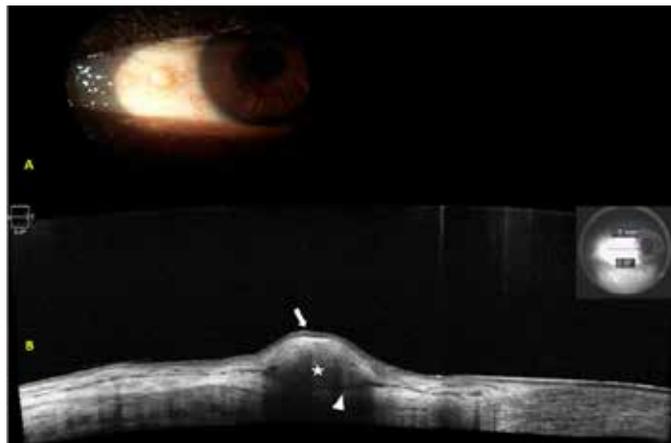


Figure 2A: Clinical photograph of eye showing a raised nodular lesion in nasal conjunctiva resembling.

Figure 2B: HD OCT scan through the lesion shows a healthy uninvolved conjunctival epithelium (arrow). Lesion appears to be within the conjunctival stroma (asterisk) with well-defined posterior border (arrow head). No blood vessel is seen above the lesion.

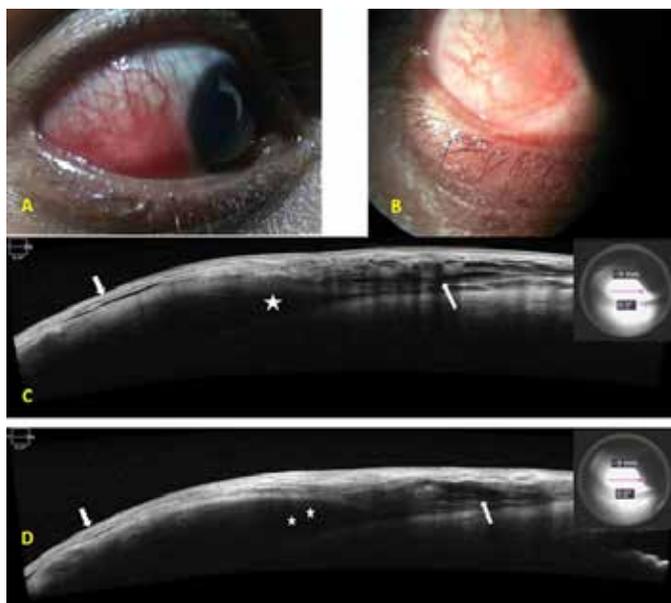


Figure 3A: Clinical photograph of eye showing a raised nodular lesion with conjunctival and deep congestion suggestive of nodular scleritis.

Figure 3B: Clinical photograph of eye as in Figure 3A after blanching with phenylephrine.

Figure 3C: HD OCT horizontal scan through the lesion showing a vague lesion (white asterisk) with extracellular fluid over and adjacent to it (white arrows).

Figure 3D: OCT scan repeated through the lesion at the same site as in Figure 3 B after blanching with phenylephrine shows that the fluid has markedly reduced in the superficial layers (white arrow) but persists in the deeper layers (white arrow). The lesion has become well-defined (white asterisk).

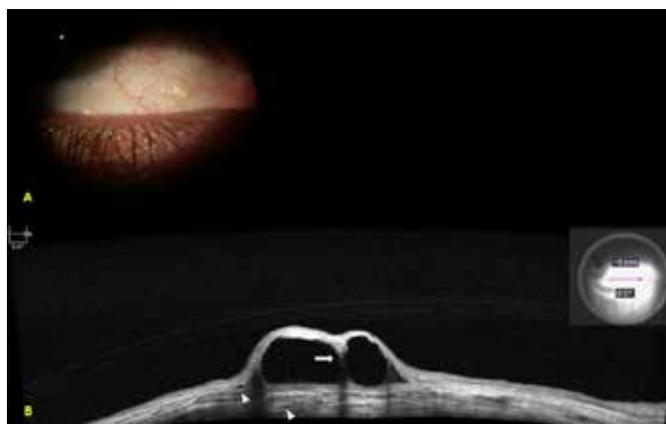


Figure 4A: Clinical photograph of eye of case 5 showing a small cystic lesion on the inferior-temporal bulbar conjunctiva.

Figure 4B: HD OCT scan through the lesion showing well-defined cystic lesion with a septa (white arrow). The cavity of the cyst shows no reflectivity and the cyst appears to be in the epithelium. Lesion is above the conjunctival vessels (arrow heads).

of nodular scleritis (Figure 3). Systemic associations were ruled out, and the lesion resolved after a week’s course of oral indomethacin with topical steroids and lubricants. No recurrences occurred until 1 month of follow up.

Case 4: A 34 yr-old female presented with gritty sensation in right eye since 1 month. BCVA was 6/6 in both eyes. On clinical examination, a small cystic lesion was seen on the inferior-temporal bulbar conjunctiva (Figure 4). OCT revealed a sub epithelial lesion with no internal reflectivity and septa was seen (Figure 4). The lesion was located above the conjunctival vessels. Diagnosis of conjunctival inclusion cyst was made. Patient was advised a combination of topical nephaszoline and methylcellulose, and the lesion resolved within 3 days.

Discussion

OCT is a very useful diagnostic tool as it is non-invasive, reproducible and repeatable.^{4,6} It is based on the principle of light interference. It works very well in tissues where cellular and acellular layers are well defined, and where tissue reflectance can be easily deciphered.⁷ This is one of the reasons why it finds enormous diagnostic utility in corneal and retinal diseases, where lesions can be easily located, and there severity graded and followed up. It is truly an optical biopsy in this situations.⁷⁻¹²

There are very few studies evaluating OCT in the perspective of extra corneal ocular surface lesions,^{1,12-15} perhaps because here the tissue is loosely packed, and layers beneath the conjunctival epithelium are difficult to decipher from each other. In this regard, we found two helpful markers for determining the location of ocular surface lesions. Firstly, there are three major vascular layers in the ocular surface – conjunctival substantia propria, superficial episcleral and deep episcleral/scleral vessels. These layers can be identified on OCT (as done in Figures 2 and 4), and therefore be used to locate the lesion in conjunctival stroma/anterior tenons/episclera/sclera. Secondly, including a section of the cornea with the OCT scan allows easier localization of lesions as corneal epithelium basement membrane complex may be

Table 1: Summary of the cases

| | Case 1 | Case 2 | Case 3 | Case 4 |
|----------------------|---|--|---|---|
| Age/Sex | 32/M | 50/F | 34/F | 34/F |
| Symptoms | Mass encroaching on cornea | Mass over eye, Referred as OSSN | Painful red swelling over eye | Gritty sensation |
| Examination findings | Nasal flat wedge shaped mass with cyst | Yellow well defined swelling | Solitary raised nodular lesion over the temporal surface with congestion of superficial and deeper vessels. Swelling persisted despite blanching with phenylephrine | A small transparent cystic lesion in right eye temporal conjunctiva |
| OCT | A conjunctival mass encroaching over the corneal surface along with a deeper cystic lesion | Healthy uninvolved conjunctival epithelium with well defined posterior border | An ill defined swelling consisting of extracellular fluid in conjunctival stroma and superficial scleral tissues. After blanching the conjunctival vessels, the lesion was better demarcated and extracellular fluid decreased. | Well defined cystic lesion with septa, the cavity of the cyst showed no reflectivity and cyst appeared to be below epithelium and above the conjunctival vessels. |
| Diagnosis | Pterygium with cyst | Pinguecula | Nodular scleritis | Inclusion cyst |
| Treatment | Excision biopsy With confirmation of diagnosis on histopathology | Patient opted for follow up. | Oral Indomethacin and topical steroid with lubricant | Decongestants |
| Outcome | No recurrence | Lesion stable for 4 months. | Resolved in 1 week. | Resolved in 3 days |
| Remarks | First OCT documentation of pterygium with cyst. The cyst appeared to be deeper than the pterygium itself. | OSSN was easily ruled out as epithelium was uninvolved, stromal location and well defined borders were other pointers. | Reduction of fluid was noted after blanching in superficial layers only and the swelling became slightly more defined. | Scolex was ruled out and presence of septa pointed against sub conjunctival cysticercosis |

OCT: optical coherence tomography, OSSN: Ocular surface squamous neoplasia

used as a linear guide (as done in Figure 1). Lastly, in cases where there is tissue edema, decongestants may be applied to normalize the anatomy prior to diagnosis (as done in Figure 3).

The cases in this series have been summarised in Table 1. To the best of our knowledge, there is no literature on OCT of pterygium with cyst. Interestingly, the cyst was found to be deeper than the conjunctival degeneration itself.^{1,2} In case 2, OCT virtually ruled out OSSN by showing a well-defined stromal lesion with normal and intact epithelium.^{12,13} In case 3, the pattern of change of extracellular fluid and location of lesion helped in confirming nodular scleritis.¹⁶ In case 4, absence of scolex along with septa helped in ruling out cysticercosis.^{17,18}

Diagnosis and differentiation of ocular surface lesions are of critical importance. While many lesions are benign, some have significant morbidity and mortality. History and clinical examination frequently yield a correct diagnosis, but in some instances, only a broad differential diagnosis is possible. Adjunctive tests, like OCT in our cases, find their utility in such situations.^{1,2} The gold standard is biopsy, but it is invasive and has its own limitations and complications.^{19,20} We found this particularly true for case 2, where normal epithelium was found and a wrong diagnosis of OSSN had been previously suspected elsewhere. However, larger studies showing correlation between internal structure and histopathological findings need to be done before OCT can obviate biopsy in selected cases.

Conclusion

OCT is a useful diagnostic adjunct for extra-corneal ocular surface lesions too. If consistent internal characters matching with histopathological features can be proved, it may also help in obviating the need of excision biopsy in selected cases.

References

1. Shousha MA, Karp CL, Canto AP, et al. Diagnosis of Ocular Surface Lesions Using Ultra-High Resolution Optical Coherence Tomography. *Ophthalmology* 2013; 120:883-891.
2. Soliman W, Mohamed TA. Spectral domain anterior segment optical coherence tomography assessment of pterygium and pinguecula. *Acta ophthalmologica* 2012; 90:461-5.
3. Pavlin CJ, McWhae JA, McGowan HD, et al. Ultrasound biomicroscopy of anterior segment tumors. *Ophthalmology* 1992; 99:1220-8.
4. Muscat S, Parks S, Kemp E, et al. Repeatability and reproducibility of macular thickness measurements with the Humphrey OCT system. *Invest Ophthalmol Vis Sci* 2002; 43:490-5.
5. Popescu DP, Choo-Smith L-P, Flueraru C, et al. Optical coherence tomography: fundamental principles, instrumental designs and biomedical applications. *Biophysical Reviews* 2011; 3:155.
6. Fercher AF, Drexler W, Hitzenberger CK, et al. Optical coherence tomography—principles and applications. *Rep. Prog. Phys.* 2003; 66:239–303.
7. Țălu SD. Optical Coherence Tomography in the Diagnosis and Monitoring of Retinal Diseases. *ISRN Biomedical Imaging* 2013; 2013:910641.
8. Adhi M, Duker JS. Optical coherence tomography – current and future applications. *Curr Opin Ophthalmol* 2013; 24:213-221.

9. Keshavamurthy R, Grover S. OCT – An Insight into Retinal Disorders. *Middle East Afr J Ophthalmol* 2008; 15:97-98.
10. Maeda N. Optical coherence tomography for corneal diseases. *Eye Cont Lens* 2010; 36:254-9.
11. Dorairaj SK, Stewart MW. Clinical applications of AS-OCT for corneal disease Bringing measurement of corneal thickness and pathology to the micron level. *Ophthalmology Management* 2014; 18:44-47, 49.
12. Sayed-Ahmed IO, Palioura S, Galor A, et al. Diagnosis and Medical Management of Ocular Surface Squamous Neoplasia. *Expert Rev Ophthalmol* 2017; 12:11-19.
13. Ong SS, Vora GK, Gupta PK. Anterior Segment Imaging in Ocular Surface Squamous Neoplasia. *J Ophthalmol* 2016; 2016:5435092.
14. Medina CA, Plesec T, Singh AD. Optical coherence tomography imaging of ocular and periocular tumours. *Br J Ophthalmol* 2014; 98 (Suppl 2):ii40-6.
15. Yim M, Galor A, Nanji A et al. Ability of novice clinicians to interpret high-resolution optical coherence tomography for ocular surface lesions. *Can J Ophthalmol* 2018; 53:150-154.
16. Watson PG, Hayreh SS. Scleritis and episcleritis. *British Journal of Ophthalmology* 1976; 60:163-91.
17. Sinha S, Takkar B, Venkatesh P, et al. High-resolution Fourier-domain optical coherence tomography findings in subretinal cysticercosis. *Retina* 2012; 32:643-4.
18. Takkar B, Mehdi MU, Ahmed NR, et al. Anterior segment optical coherence tomography of live ocular cysticercosis. *Clinical & experimental ophthalmology* 2014; 42:896-8.
19. Nanji AA, Moon CS, Galor A, et al. Surgical versus medical treatment of ocular surface squamous neoplasia: A comparison of recurrences and complications. *Ophthalmology* 2014; 121:994-1000.
20. Eide N, Walaas L. Fine-needle aspiration biopsy and other biopsies in suspected intraocular malignant disease: A review. *Acta Ophthalmol* 2009; 87:588-601.

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Address for correspondence

Mihika Dube MS

Department of Ophthalmology,
All India Institute of Medical Sciences,
Saket Nagar, Bhopal, India
Email id: mihikadube@gmail.com



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