CASE REPORT

Three-dimensional spectral domain optical coherence tomography in vitreomacular traction

Sandeep Saxena,¹ Manisha,¹ Carsten H Meyer,² Levent Akduman³

¹Department of Ophthalmology, King George's Medical University, Lucknow, Uttar Pradesh, India

²Department of Ophthalmology, Pallas Klinik, Olten, Switzerland

³Department of Ophthalmology, St Louis University, St Louis, Missouri, USA

Correspondence to
Professor Sandeep Saxena,
sandeepsaxena2020@yahoo.
com

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SUMMARY

Spectral domain optical coherence tomography (SD-OCT) is a non-invasive tool providing unprecedented imaging and analysis of vitreomacular interface. Two cases of vitreomacular traction were analysed by advanced three-dimensional (3D) SD-OCT imaging. En-face OCT permitted localisation of the exact point of attachment of vitreous to retina. A comprehensive view of the surface topography and anatomical configuration of vitreomacular affection was revealed by 3D imaging with segmentation technique. Macular change analysis programme revealed progression to full-thickness macular hole in the second case. Non-invasive high-resolution SD-OCT imaging has transformed the understanding and management of vitreomacular traction. Its role is further reinforced by the introduction of ocriplasmin for management of vitreomacular adhesions.

BACKGROUND

Vitreomacular traction (VMT) results from attachment of vitreous to the retina leading to structural alterations in the macula. It has been implicated in the pathogenesis of a variety of diseases such as epiretinal membrane and macular hole. The disease course of VMT is variable. It may have a long stable course, resolve spontaneously or it may result in full-thickness macular hole (FTMH) formation.^{1–3}

The management of VMT includes observation for asymptomatic and vitrectomy for symptomatic VMT. Vitrectomy is invasive and has its inherent surgical risks. Therefore, clinicians have been on the lookout for a non-invasive alternative like ocriplasmin. The current indications of ocriplasmin include adult patients with focal symptomatic VMT and smaller macular holes (<400 µm) as outlined in the MIVI trials.⁴

Optical coherence tomography (OCT) has become an invaluable tool for diagnosing VMT. Spectral domain optical coherence tomography (SD-OCT) provides exceptional imaging quality which helps in the diagnosis and management.

CASE PRESENTATION

Case 1: A 77-year-old man presented at our tertiary care centre with the symptoms of gradual progressive diminution of vision of right eye associated with photopsia and micropsia. Best-corrected Snellen's visual acuity of the right and the left eye was 20/200 and 20/20, respectively. Slit-lamp biomicroscopic examination of both the eyes revealed pseudophakia. Stereoscopic fundus examination of the right eye revealed macular thickening. Folds of the inner limiting membrane (ILM) were also

Figure 1 Linear optical coherence tomography scan of the right eye through the fovea showing vitreomacular traction resulting in marked retinal elevation. The adjacent retinal layers are normal. A single point of contact between fovea and the vitreous can be distinguished (arrow).

observed. Fundus examination of the left eye was unremarkable. Linear SD-OCT scan of the right eye through the fovea revealed VMT resulting in marked retinal elevation. The central macular thickness was 458 µm. The adjacent retinal layers were normal. A single point of contact between fovea and the vitreous could be distinguished (figure 1). The C scan (enface scan) at the level of ILM showed the exact point of attachment of vitreous to fovea

Figure 2 The C scan section at the level of inner limiting membrane showing the exact point of attachment of vitreous to fovea (arrow).

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Figure 3 Three-dimensional spectral domain-optical coherence tomography highlighting the point of vitreomacular attachment at the fovea (arrow). Additionally, an area of extrafoveal vitreomacular adhesion can also be visualised (arrowhead).

(figure 2) which could be compared to corresponding scanning laser ophthalmoscope image. On three-dimensional (3D) SD-OCT, the point of vitreomacular attachment at the fovea was highlighted. Additionally, an area of extrafoveal vitreomacular adhesion was also visualised (figure 3). At 1-year follow-up, visual acuity of the right eye was maintained at 20/200.

Case 2: A 61-year-old man presented with the symptoms of photopsia with gradual painless blurring of vision in the right eye for the duration of 8 months. Visual acuity in the right eye was 20/60 while in the left eye it was 20/20. Anterior segment

examination was unremarkable with pseudophakia in both the eyes. On stereoscopic fundus evaluation loss of central foveolar reflex was noted associated with thickening of the macula. On SD-OCT, an epiretinal membrane was observed. A large cystoid space was seen in the foveal region with few small hyporeflective cystoid spaces below the ILM. A moderately reflective band was seen arising from the fovea extending into the vitreous cavity representing the attached part of the posterior hyaloid to the inner retina. Mild intraretinal layer separation was evident within the layers of the outer retina (figure 4). False colour-

Figure 4 Linear optical coherence tomography scan of the right eye in case 2 showing an epiretinal membrane. A large cystoid space is seen in the foveal region with few small hyporeflective cystoid spaces below the inner limiting membrane. A moderately reflective band is seen extending from the fovea into the vitreous cavity representing the attached part of posterior hyaloid to the inner retina (arrows). Mild intraretinal layer separation is evident within the layers of the outer retina.

Figure 5 (A) False colour-coded macular thickness map showing marked elevation at fovea (arrowheads). (B) Inner limiting membrane (ILM) topography map showing the corresponding elevation of ILM at the points of vitreous attachments (arrowheads).

coded macular thickness map showed marked elevation at fovea (figure 5A). On segmentation, ILM topography map showed the corresponding elevation of ILM at the points of vitreous attachments (figure 5B). On 3D OCT advanced visualisation, the point of vitreous attachment to fovea could be discerned along with identification of two additional areas of vitreomacular attachment within the macular cube (figure 6).

Follow-up visit at 27 months showed a FTMH with an epiretinal membrane in the right eye, as a result of persistent VMT. SD-OCT macular change analysis programme was utilised. Inner limiting membrane-retinal pigment epithelium (ILM-RPE) difference false colour-coded map highlighted the changes in macular thickness. Extracted B scans compared the SD-OCT linear scans to highlight the progression of the disease (figure 7). The left eye was unremarkable.

Figure 6 Three-dimensional coherence tomography demonstrating the point of vitreous attachment to the fovea (arrow) with two additional areas of vitreomacular attachments seen within the macular cube (arrowhead).

INVESTIGATIONS

Fundus photography, SD-OCT.

OUTCOME AND FOLLOW-UP

At 1-year follow-up, visual acuity of the right eye was maintained at 20/200 in case 1. In the second case, however, follow-up visit at 27 months showed a FTMH with an epiretinal membrane in the right eye, as a result of persistent VMT.

DISCUSSION

Advanced 3D imaging by SD-OCT provided unmatched insight into VMT. It also assisted in visualising *in vivo* histology of the disease. En-face OCT permitted localisation of the exact point of attachment of vitreous to retina in case 1. Additionally, 3D imaging along with segmentation techniques provided comprehensive evaluation of the surface topography as well as foveal and extrafoveal anatomical configuration of vitreomacular affection.

VMT has been reported to have a stable course,¹ however, some may progress to macular hole. Odrobina *et al* described and analysed the natural course of VMT. They highlighted what factors may affect the spontaneous resolution of VMT. They also reported the formation of an FTMH in the VMT disorder.³ Macular change analysis programme, in SD-OCT, provides an innovative and accurate means of assessment of disease progression. This programme may be instrumental in deciding timely pharmacological and surgical intervention.

Non-invasive high-resolution SD-OCT imaging has become instrumental in providing global view of VMT as highlighted in our cases. An OCT-based classification of VMT as highlighted in our cases. An OCT-based classification of VMT has been recently introduced based on extent of vitreous attachment.⁵ Careful evaluation of the vitreomacular interface with SD-OCT has increased in importance with the introduction of ocriplasmin, a pharmacological means of vitreolysis. Data from the ocriplasmin (Jetrea) MIVI-TRUST Phase III clinical trials for the treatment of vitreomacular adhesion as well as macular holes has highlighted that patients with focal VMT and those with smaller macular holes show beneficial effect.⁴ There have been

Figure 7 Inner limiting membrane-retinal pigment epithelium (ILM-RPE) difference false colour-coded map highlighting the changes in macular thickness. Extracted B scans comparing the spectral domain-optical coherence tomography (SD-OCT) linear scans to highlight the progression of the disease.

recent reports of adverse events in a few cases treated with ocriplasmin.^{6 7} This further underlines the need for a careful patient selection. A detailed evaluation regarding size and number of attachment(s) may thus go a long way in preventing poor visual outcome. This reinforces the role of en-face and 3D OCT in highlighting vitreomacular attachment(s) and identifying suitable cases for ocriplasmin therapy.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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Learning points

- ▶ Spectral domain optical coherence tomography imaging is instrumental in the meticulous planning of management of vitreomacular traction.
- ▶ Macular change analysis programme provides an innovative and accurate means of follow-up of disease progression.
- ▶ Assessment of vitreomacular interface with spectral domain-optical coherence tomography has significantly increased in importance with introduction of ocriplasmin.

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