Management of New or Recurrent Choroidal Neovascularization in Telescope-Implanted Eyes

Abstract

Purpose: To describe the optical coherence tomography (OCT) imaging techniques and anti-vascular endothelial growth factor (anti-VEGF) injection protocol for patients with neovascular age-related macular degeneration (AMD) and an implantable miniature telescope (IMT).

Methods: For patients with a telescope-implanted eye, OCT images from both Zeiss Cirrus HD-OCT and Heidelberg Spectralis SD-OCT were performed to allow for visualization of subretinal fluid and the treatment response to anti-VEGF injections.

Results: Patients with telescope implanted eyes that develop recurrent choroidal neovascularization can be successfully managed with serial optical coherence tomography and a series of anti-VEGF injections.

Conclusions: High resolution OCT imaging is possible in telescope implanted eyes and can be utilized during management of AMD to detect neovascularization recurrences and to monitor the effects of anti-VEGF treatments.

Key Words

high-definition OCT (HD-OCT), spectral-domain OCT (SD-OCT), age-related macular degeneration (AMD), anti-vascular endothelial growth factor (anti-VEGF), implantable miniature telescope (IMT)

Introduction

Patients with end-stage age-related macular degeneration (AMD) experience central blind spots, or scotoma, due to disciform scarring and geographic atrophy in their macular regions, making it difficult to recognize images in their central field of vision. The Implantable Miniature Telescope (IMT; VisionCare Ophthalmic Technologies) is FDA (United States Food and Drug Administration) approved for patients diagnosed with end-stage atrophic AMD. The IMT reduces the effect of a central scotoma by magnifying images in the central field of vision by 2.2X to 2.7X, and projects them onto healthy, non-affected perimacular retina; making it possible to distinguish once unrecognizable images centrally.\(^1\)\(^,\)\(^2\) For patients with end-stage AMD, the IMT has been shown to enhance quality of life and vision by reducing the size and the effects of their central scotoma.\(^2\) Although the IMT has only been approved for atrophic end-stage AMD, there is a likelihood that a small percentage (less than 0.5%) of eyes will develop choroidal neovascularization (CNV) following implementation.\(^1\)\(^,\)\(^3\) Figure 1 is an anterior segment view of an eye implanted with the IMT; this image was captured using Heidelberg Engineering SPECTRALIS\(^\circledR\) Spectral-Domain OCT technology.
**OCT Imaging in IMT Eyes**

For patients with end-stage AMD and an IMT, there is a need to perform serial OCT imaging during anti-VEGF therapy to diagnose CNV, monitor the progression of the disease and the effect of treatments. It is difficult to obtain a clear view of the macula through the IMT during ophthalmoscopy; the telescope severely minimizes the view of the retina. Figure 2 is an image of the retina through an IMT using the SPECTRALIS® SD-OCT confocal scanning laser ophthalmoscopy (cSLO); note the minimized view of the fundus and that the view of the macula is not clear. When performing diagnostic OCT imaging of the retina through an implantable telescope, the IMT presents several unique imaging challenges: difficulty obtaining a clear view of the macula through the IMT, and inability of the patient to focus on the fixation target due to loss of central vision from end-stage AMD. Due to these imaging obstacles, it may take longer to capture OCT images in patients with the IMT, resulting in increased corneal exposure. Some tactics imaging technicians may employ to overcome these obstacles to capture high-quality OCT images include ocular surface lubrication (use artificial tears and encourage continued blinking when appropriate), good dilation of the pupils, and using anatomical landmarks (such as the optic nerve) to locate the macular region. Despite these imaging challenges, the OCT is a useful and valuable clinical resource in the treatment and management of AMD in telescope implanted eyes.

**Anti-VEGF Injections in IMT Eyes**

Although focal laser photocoagulation can be performed through the IMT, the standard of care for treatment of new or recurrent CNV are anti-VEGF injections to prevent any further compromise to their central vision. Typically, when patients with end-stage AMD and IMT develop new or recurrent CNV, they usually only require a shorter course of anti-VEGF treatments. A shorter course of treatment is usually adequate and is recommended to prevent geographic atrophy from worsening which may in turn further compromise the central scotoma in end-stage AMD. Figure 3 shows images of a retina in an IMT eye both prior to and after a series of 4 anti-VEGF treatments (bevacizumab) for new CNV following IMT implantation; these images were captured on the Zeiss Cirrus HD-OCT modality. The author’s preference for treatment is three monthly injections followed by close monitoring and additional injections on an as needed basis (PRN as CNV recurs), using any of the anti-VEGF agents currently available: aflibercept (Eylea; Regeneron), bevacizumab (Avastin; Genentech), or ranibizumab (Lucentis; Genetech). OCT imaging should be performed at every visit to monitor the progression of CNV as well as assess the efficacy of anti-VEGF treatments.

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**Figure 2:** Heidelberg SPECTRALIS® SD-OCT cSLO image of the retina through an IMT. This photo depicts the difficulty in obtaining a clear view of the fundus through the IMT. Note the minimized appearance of the fundus. (*Photo: Anna Pappas, BS, COA*)

**Figure 3:** Zeiss Cirrus HD-OCT images of retina in an IMT eye before and after a series of 4 intravitreal anti-VEGF injections. Pretreatment (a) and Posttreatment (b); note the pocket of subretinal fluid in image a (white arrow), and the subretinal fluid is resolved in image b. (*Photos: Martha Schlimgen, OSC*)
INJECTION PROTOCOL IN IMT EYES

Although the treatment of CNV in IMT eyes is similar to the treatment of exudative AMD in eyes without an IMT, special modifications to the injection protocol must be made to accommodate the IMT. Due to the size (4.4 mm length x 4.2 mm diameter) and posterior location of the IMT, physicians must take great care while performing an anti-VEGF injection to minimize the risk of the needle contacting or possibly damaging the IMT. When the IMT is placed into the capsular bag after phacoemulsification, the length of the IMT stretches the posterior capsule (the IMT protrudes into the posterior chamber while remaining in the capsular bag). Due to the IMT’s unique geometric dimensions, having a larger volume and larger proportions than the standard intraocular lens, the injection needle should be directed more posteriorly to reduce the risk of either damaging the telescope or perforating the capsular bag, with a location of 3.5 mm posterior to the limbus and a greater angulation than normal aimed towards the optic nerve. Figure 4 is a graphic illustration of the recommended angulation and insertion points for performing an intravitreal injection in an IMT eye.

One consideration that should be taken before performing an intravitreal injection in an IMT eye is recent implantation; if an anti-VEGF injection is required in the early IMT implantation postoperative period, the intravitreal injection should be performed away from the surgical wound area. After implantation, the IMT surgical wound has a large sutured incision at the limbus (the IMT is implanted into a 12 mm incision), and care should be taken to avoid any excessive pressure on the globe which could cause contact between the anterior window of the IMT and the corneal endothelium. After the anti-VEGF intravitreal injection, it may be difficult for the physician to examine the fundus as well as verify perfusion of the optic nerve head due to the minified view through the IMT. Therefore, it is recommended that the patient with IMT is asked to verify hand motion following the injection procedure to confirm that the optic nerve is still perfused.

CONCLUSIONS

New or recurrent choroidal neovascularization in IMT eyes can be treated and managed in a manner similar to treatment for exudative AMD in eyes without the IMT. Even though there may be challenges examining the macula or performing OCT imaging through the IMT, OCT scans are still a valuable resource in detecting CNV and monitoring the treatment response to anti-VEGF intravitreal injections in IMT eyes. As long as careful considerations for the IMT are taken when performing intravitreal injections, anti-VEGF treatments can be safely administered in IMT eyes.

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REFERENCES