EDITORIAL

香 港 眼 科 醫 學 院

# Optical coherence tomography-3 — more information, more user friendly?

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Optical coherence tomography (OCT) is a new diagnostic tool to image biological tissue with high resolving power. The operation of OCT is similar to that of ultrasound B-scan imaging except it utilizes light waves rather than acoustic sound waves. Because of this difference, the axial resolution of OCT is as high as 10 μm, compared with 150 μm of that of a conventional 10-MHz B-scan ultrasound. OCT is a non-contact examination, which improves patient comfort and allows the test to be performed in less time. For certain conditions such as age-related macular degeneration, OCT is able to reduce or eliminate the need for fluorescein angiography for some patients. The main use of OCT has been in the posterior segment, although some investigators have reported its usefulness in documenting anterior segment pathology.

OCT is currently in its third generation (OCT-3) and OCT-3 has been available for almost 2 years. The main difference from the OCT-1 and OCT-2 is that OCT-3 uses a shorter wavelength of 820 nm. Furthermore, the OCT-3 can make up to 512 retinal measurements ('A-scan') for each radial scan diameter, whereas the OCT-1 makes only 100 measurements, resulting in greater measurement precision. OCT-3 gives an in vivo examination of the retina, in particular the macula. Toth et al found that retinal morphology and macular OCT findings correlate well.[1] OCT has given important new information that sometimes changes our understanding of many retinal diseases and a good example would be optic disc pit.

Optic disc pit was first described by Wiethe[2] and the incidence is estimated to be 1 in 10,000 eyes. Approximately 10% to 15% of the reported cases were bilateral. Approximately 70% of the pits are on the temporal side of the disc, and 20% are centrally situated. Serous retinal detachment in the macular region may be associated with optic disc pits.

In this issue of the *Hong Kong Journal of Ophthalmology*, Dr Yong Li and colleagues describe 3 patients with optic disc pit and report their specific OCT findings. They found that the disc pit was consistently seen on OCT as a defect on the optic nerve fiber layer. Although no neurosensory or pigment epithelial detachment was observed in their patients, they suggested that OCT might be useful to pick up detachments not clinically apparent. In their series, OCT could have been further applied to analyze the nerve fiber layer thickness. Since visual field defects were present in all 3 of their patients, it would be interesting to know the retinal nerve fiber layer (RNFL) changes, their correlation to the site of the pit, and the long-term progression. Meyer et al recently reported the RNFL changes of an optic disc pit measured using OCT.[3] These authors found a reduced mean RNFL thickness with significant loss, especially in the papillomacular bundle.

Several investigators have described the unique bilaminar appearance of optic disc pit maculopathy using OCT.[4-6] Lincoff and Kreissig postulated that fluid from an optic disc pit creates an inner layer separation (ILS) of the retina.[7] An outer layer detachment (OLD) centered on the macula is a secondary phenomenon that causes a dense central scotoma. These researchers confirmed this theory using OCT, showing that ILS was connected with the optic disc pit. External to it was an OLD that centered on the fovea and did not connect with the optic disc pit.

Although no histopathological studies were available to confirm the 2-layer structure of optic disc pit maculopathy, OCT has provided compelling evidence to support this. Lincoff and Kreissig also showed that after successful pneumatic displacement, the improvement in central vision coincided with a reattachment of the OLD in the macula.[7] Their results also support the hypothesis that the ILS, which persists, provides a conduit for the continuous flow of fluid from the pit to the displaced retinal elevation. Hassenstein and Richard have also recently reported the OCT features of 8 patients with optic disc pit with associated maculopathy.[8] In clinically suspected 'pseudo' macular hole, OCT revealed foveal schisis. In 6 patients, OCT demonstrated a retinal detachment with a typical convex schisis of the outer retinal layer and 3 patients showed a neurosensory detachment with or without intraretinal cystoid formation.

There have been many controversies regarding the pathophysiology of serous detachment associated with optic disc pit. The most widely accepted explanation was originally proposed by Sugar[9] and later endorsed by Brockhurst.[10] Sugar proposed that fluid from vitreous leaked through the optic pit to fill the subretinal space.[9] Brown et al provided further supporting evidence that more than 75% of patients with optic disc pit-associated macular detachment had posterior vitreous detachment.[11] In addition, a direct connection between the posterior vitreous space and the subretinal space was experimentally demonstrated in a dog.[12] Gass suggested that cerebrospinal fluid might leak from the optic nerve subarachnoid space into the optic pit and from there into the subretinal space.[13] However, intrathecal fluorescein injection in human, animal, and histological studies have failed to demonstrate such communication. Using OCT, Krivoy et al showed communication between the schisis cavity or subretinal space and the optic nerve pit.[4] However, they failed to find a direct communication between the subretinal space and vitreous cavity.

There is no proven treatment for optic disc pit-associated macular detachment to date. Different methods including peripapillary laser photocoagulation,[10] pneumatic displacement,[5,7] macular buckling,[14] and a combination of pars plana vitrectomy and laser photocoagulation with gas tamponade[15] have been reported with variable success. However, most of these reports were confined to case reports or small case series without standardization, randomization, and long-term follow-up. The low incidence of this entity makes it difficult to obtain series large enough to determine the efficacy of the different modalities of treatment and to be able to suggest a procedure of choice. OCT was found to be useful to diagnose and monitor the progression of disease and the response to treatment in a quantitative fashion.

The availability of newer diagnostic tools such as OCT-3 has taken us to new heights in our understanding of the pathogenesis of many macular diseases. It is foreseeable that in the years to come, many current anecdotal theories and hypotheses will be challenged by new information obtained from these newer forms of investigation.

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