Case Reports

Are Diagnostic Eye Drops Necessary for Optometrists in Primary Eye Care?

Liang Hwee Koh[1*], Dominic De-Ying Chen[2], David Pei-Cheng Lin[2*]

[1]Singapore Optometric Association
[2]School of Medical Laboratory and Biotechnology, Chung Shan Medical University

Abstract:

Although the development of optometry has been ongoing for nearly a century, the demand of primary eye care remains hardly met due the ever increasing task of human eye for our daily work and activities. Excellent training and capacity of optometrists, application of novel technologies for eye exam, and proper legislation of practice scope for optometrists will help to elevate the standard for primary eye care. In North America and some other areas, the use of diagnostic eye drops is allowed for optometry practice. Still, in some other areas, it is not allowed in primary eye care practice. Under current situation, this restriction will not protect either the optometrists or the patients. Instead, optometry practice will be handicapped. It poses a risk of losing eye health of patients and the optometrists might carry a judge of "poor examination performance", especially for the patients who approach a clinical examination for the first time. In this article, we illustrated the use of new technologies as a temporary solution. Some clinical cases are used as examples and the results after referring to ophthalmologists are shown. The importance of using diagnostic eye drops is concluded and it should be aimed as a long term solution for better primary eye care practice.

Keywords: primary eye care, diagnostic eye drops, case reports

TOVS, 2016; 1(2): 35-44

*Corresponding author: **Liang Hwee Koh**
Singapore Optometric Association.
E-mail: **pearslsoptical@singnet.com.sg**

*Corresponding author: **David Pei-Cheng Lin**
School of Medical Laboratory and Biotechnology, Chung Shan Medical University.
E-mail: **pcl@csmu.edu.tw**

Optometry legislation without the right to use diagnostic eye drops

In Singapore as well as in Taiwan, optometry legislation includes optometrists to handle the correction of refraction conditions, prescribing optical appliances include contact lenses and detecting eye abnormalities by using binocular vision tests, ophthalmoscopy or fundoscopy, retinoscopy, slit lamp examination, tonometry and visual field testing . When it comes to deeper ocular examinations via mydriasis by using diagnostic eye drops such as clopentolate, atropine and tropicamide, it's suspended by law due to multiple reasons. However, in some special cases, to exam eye deeply with the use of diagnostic eye drops is necessary. The current situation of not using diagnostic eye drops could pose a risk on not only the reliability of examination, but also on optometrists' performance in identification of crucial diseases that might be lethal to the patients.

Without the right to use diagnostic eye drops , optometrists will face difficulties, including (1) limited field of view of the retina in ophthalmoscopy (direct or indirect), (2) almost impossible to do binocular indirect ophthalmoscopy, (3) unable to do Goldman Applanation Tonometry , (4) unable to do cycloplegic refraction , (5) unable to do gonioscopy . The restriction will handicap clinical practice of optometrists and the skills that were taught in school such as Binocular Indirect Ophthalmoscopy , Volk Lenses, Gonioscopy ,Goldman Applanation Tonometry would be wasted.

Use new instruments to circumvent current restrictions

To circumvent such restrictions, the only solution so far would be to go for new technologies. Taking Pearl's Optical Co. Pte. Ltd. (Singapore) for example, the first purchase of novel instrument was in 1998 for TRC NW5S (Non Mydriatic Digital Fundus Camera), which was followed by the installments of Topcon 3D OCT 1000 in June 2008, Topcon 3D OCT 2000 in September 2012, and Topcon Swept Source OCT (Triton) in September, 2016 (Figure 1). The practical uses of these instruments are multi-fold. Taking the Topcon 3D OCT for example, it may be used for retinal fundus photography (Figure 2), anterior imaging and assessments including pachymetry (Figure 3), keratometry (Figure 4), anterior chamber angle determination (Figure 5), posterior imaging for the vitreo-retinal interface, and may be used to conduct imaging of intra-retinal structures for maculopathy screening (Figure 6). Multiple scan modules may be adopted as an alternative to gonioscopy. The scan module may be routinely used for 12mm x 9mm wide

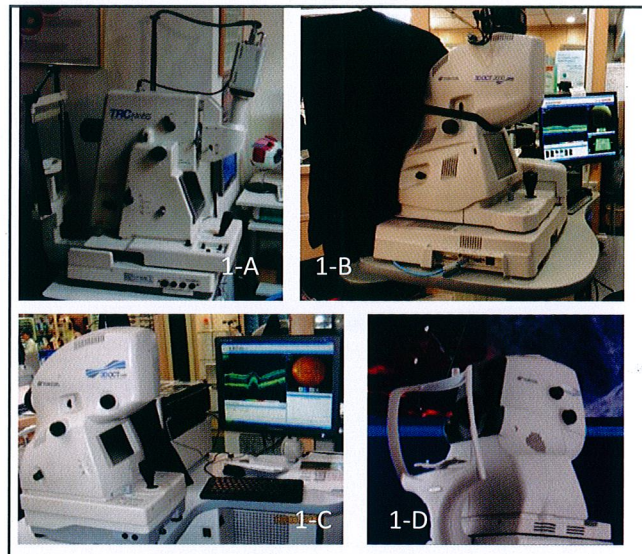
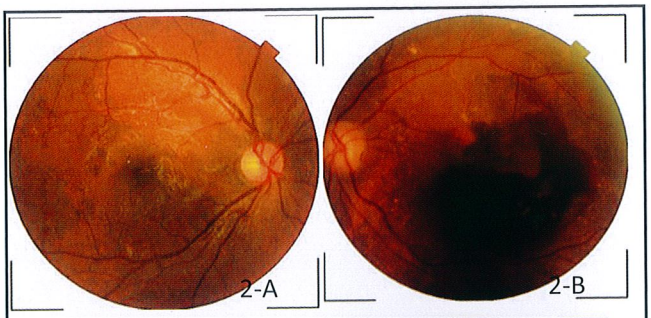


Figure 1: Application of instruments for non-mydriatic diagnosis. A:TRC NW5S (Non Mydriatic Digital Fundus Camera); B : Topcon 3D OCT 1000; C: Topcon 3D OCT 2000; D: Topcon Swept Source OCT (Triton).



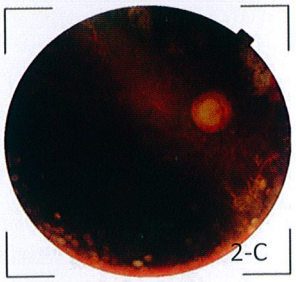
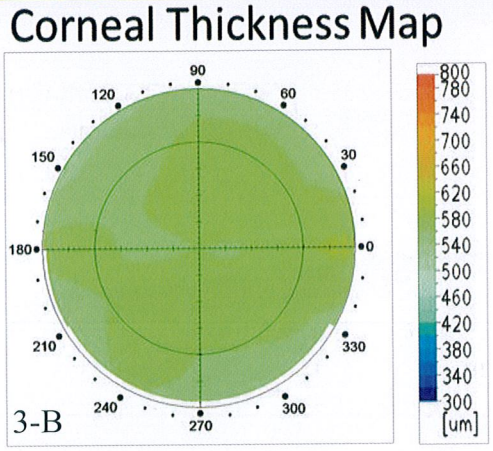
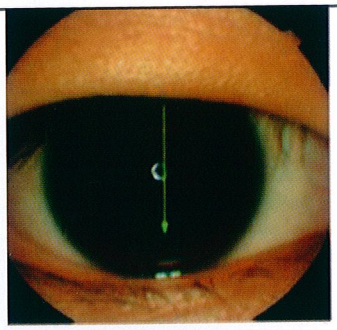


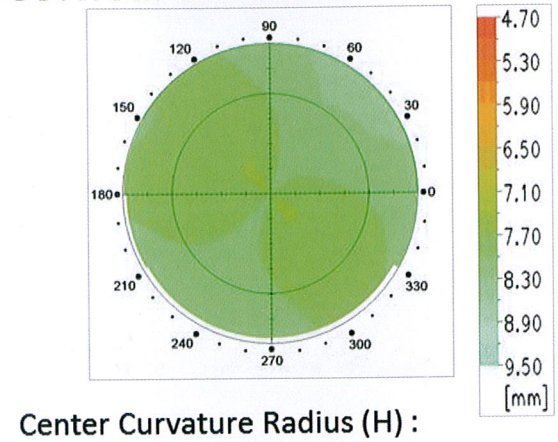
Figure 2:
A: Features of dot hemorrhages and characteristic cellophane maculopathy.
B: Massive sub-retinal hemorrhage.
C: Blur image due to small pupil. Superior part of the optic disc showed dark lesion and the optic disc was pale with big cup disc ratio (glaucoma).



Center Corneal Thickness : 564um

Figure 3: 3-A: Cross-sectional view of the cornea. The top layer is the corneal epithelium. 3-B: Corneal thickness map. The central corneal thickness was 564 um.





Center Curvature Radius (H) : 7.95mm
Center Curvature Radius (V) : 8.00mm

Figure 4: Keratometry. Top: Anterior image of the eye, showing where the curvature of the cornea was measured. Bottom: Corneal typography mapping.

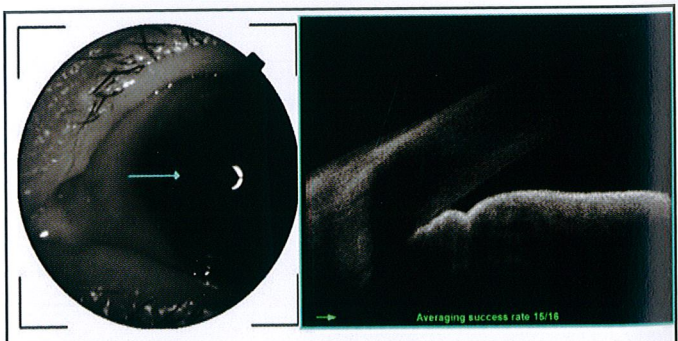


Figure 5: Left: frontal view of the left eye, the blue line at the nasal side showed the area where the OCT was scanning. Right: The OCT image showing closed anterior chamber angle.

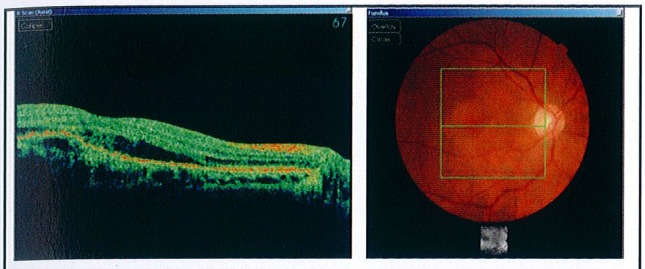


Figure 6: Right: The retina photo of the right eye. Left: OCT image of the macula (correspond to the green horizontal line across the macula in the retina photo). OCT showed detachment of the retinal pigment epithelial layer and separation of the intra-retinal layer around the macula region.

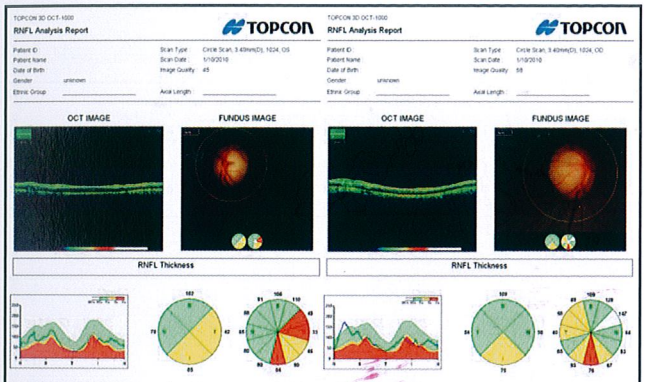


Figure 7: Left: RNFL analysis of the left eye. The red area in the round chart showed retinal nerve fiber layer thinning at the temporal and inferior region of the optic nerve. Right: RNFL analysis of the right eye showed retinal nerve fiber layer thinning at the inferior region of the optic nerve.

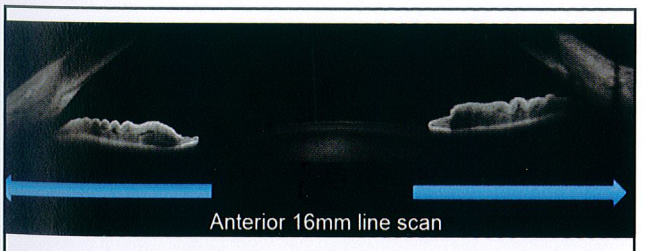


Figure 8: Anterior OCT scan showed the anterior chamber from the temporal limbal to the nasal limbal.

scan (width x height) and is therefore good for measurement of retinal nerve fiber layer (RNFL) analysis in glaucoma screening (Figure 7). Even with patients' small pupils, the optometrists can still get reasonable nice OCT images. The newest Topcon Swept Source OCT (Triton) can be used for further wider scan, to further extend the anterior scan line to 16 mm (Figure 8).

Added to the aforementioned features, Topcon Swept Source OCT (Triton) may be used to perform OCT Angiography as an alternative to fluorescein angiography (Figure 9). With addition of Optos-Ultra field retinal camera, 200 degrees of fundus image can be obtained, which is about 80% of the entire circumference of retina, highly contrasted to the traditional 45 degrees angle encompassing about only 15% circumference of the retina.

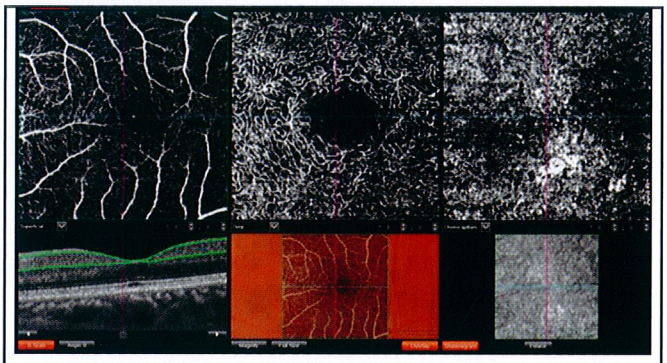


Figure 9: OCT angiography of a normal eye. Top Left: OCT angiography showed the blood vessels of the superficial to internal limiting membrane of the retina. Bottom Left: OCT B scan showed the exact level at which the OCT angiography (Top Left) was taken. Top center: Deep capillary plexus shown in OCT angiography scan. Bottom Center: superimposed OCT angiography scan (Top Left) with retina photo. Top Right: Chorio-capillaris shown in OCT angiography scan. Bottom left: Enface image (structural view) of the chorio-capillaris.

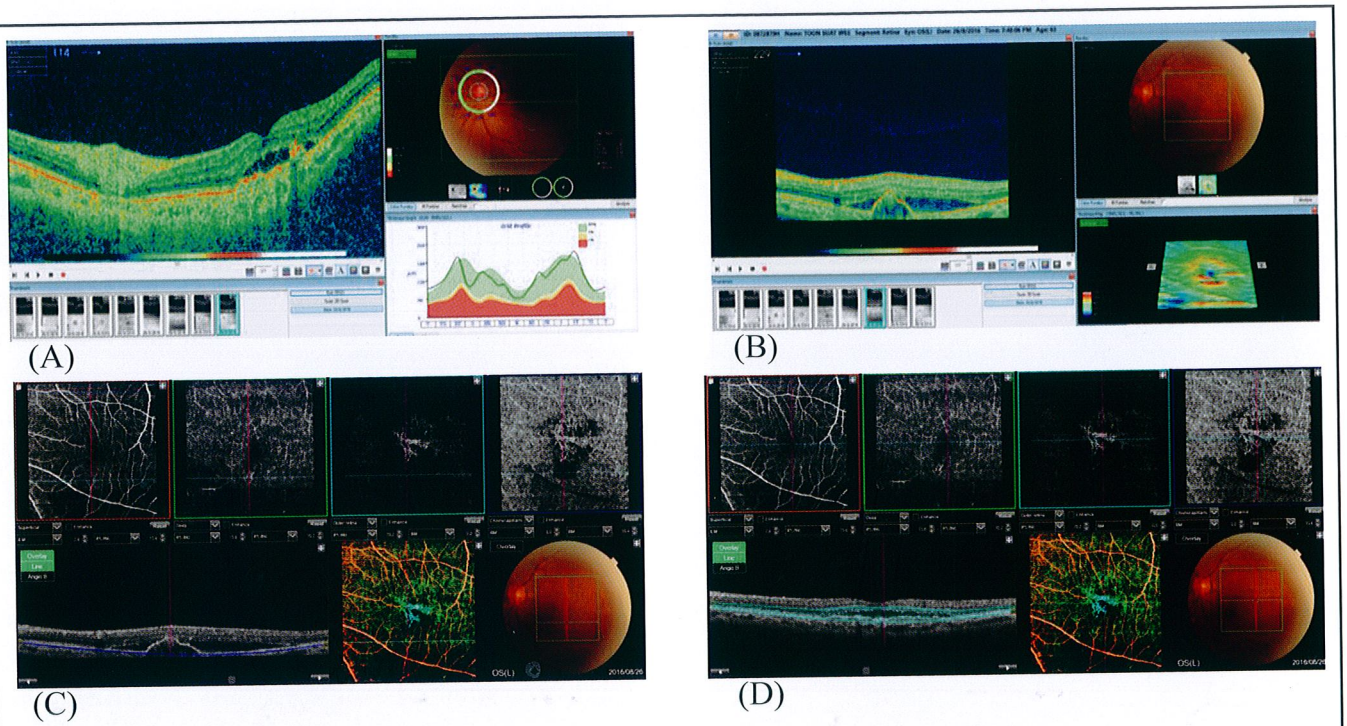


Figure 10: (A) OCT scan at the fovea region showed separation of the sensory cell layer. RNFL was normal. (B) OCT scan at the inferior part of the fovea showed both separation of sensory cell layer and detachment of the retinal pigment epithelial. (C) OCT Angiography at the fovea area. Outer retinal to inner plexiform layer, there was sign of vascularization(D) OCT Angiography at the detachment of the retinal pigment epithelial area, did not show any vascularization. The dark round patch showed there was no blood flowing . (ie. Non perfusion area).This was a case of wet age related macular degeneration. Patient was referred to the ophthalmologist for anti-VEGF intravitreal injection.

Case report 1: wet age-related macular degeneration

Male, >60 yrs old, had history of diabetes and high cholesterol. Did not have eye health check before. Cannot see far well; wanted to make new spectacle.

Refraction:
RE +2.00DS VA 6/6
LE +1.50DS VA 6/12 NIPH

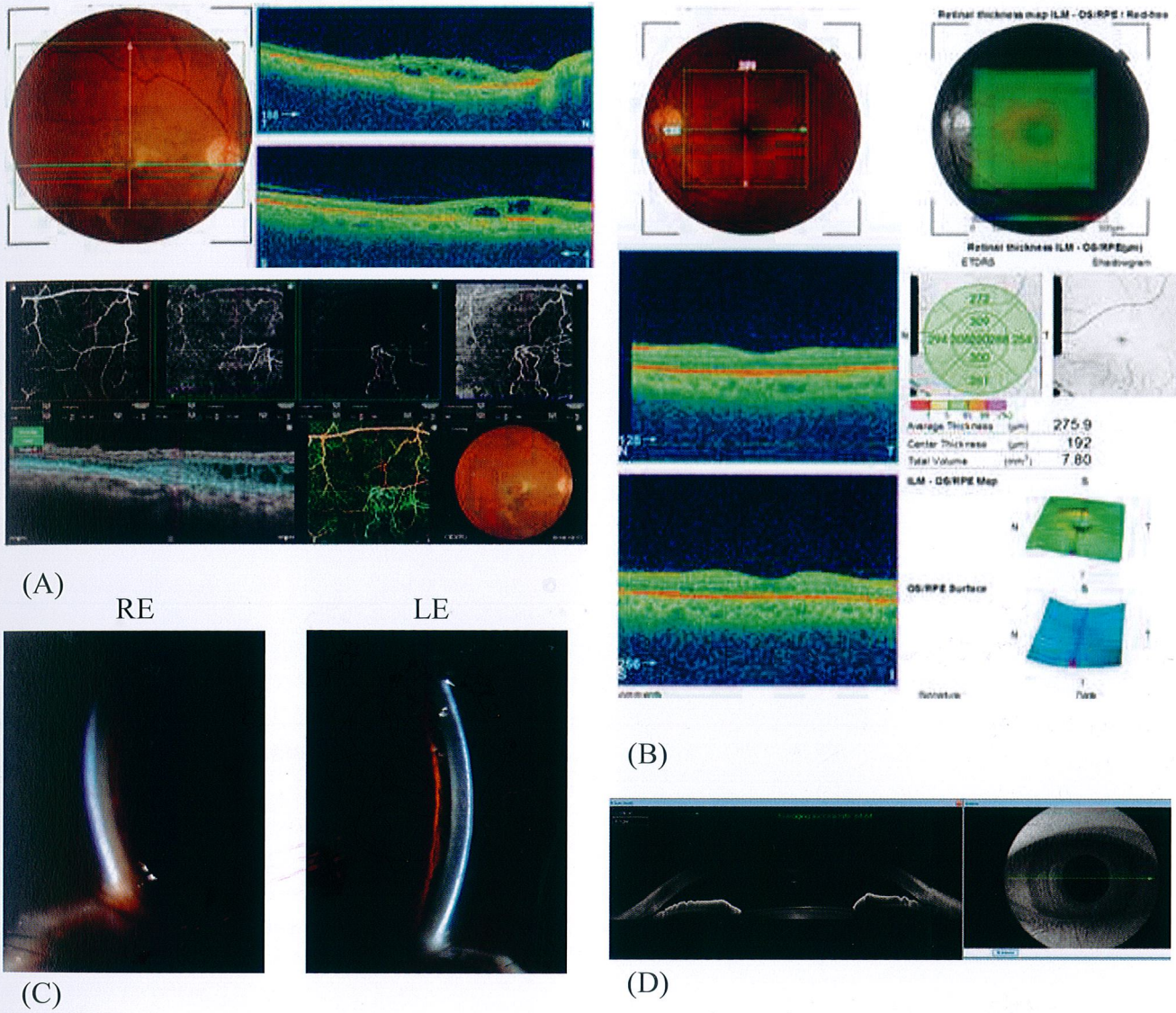


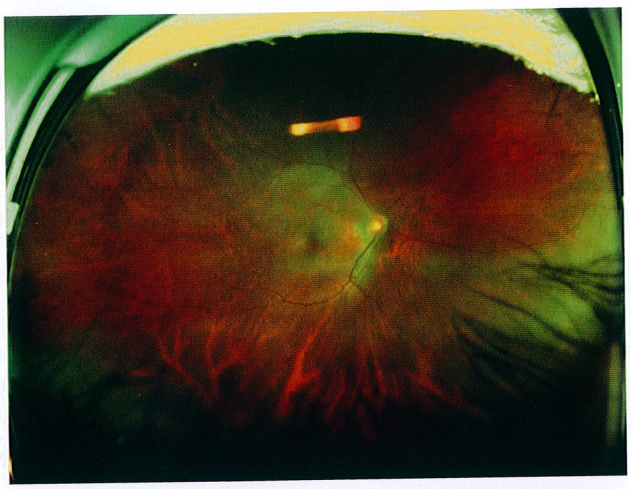
Fig 11: (A) RE had a history of maculopathy which showed in fundus photo and OCT scans. (B) OCT Scan of the left eye showed no abnormality. (C) Van Herrick showed very narrow anterior angles. (D) Anterior OCT confirmed that the anterior chamber angles were almost closed at the temporal and nasal area.

Case report 2:

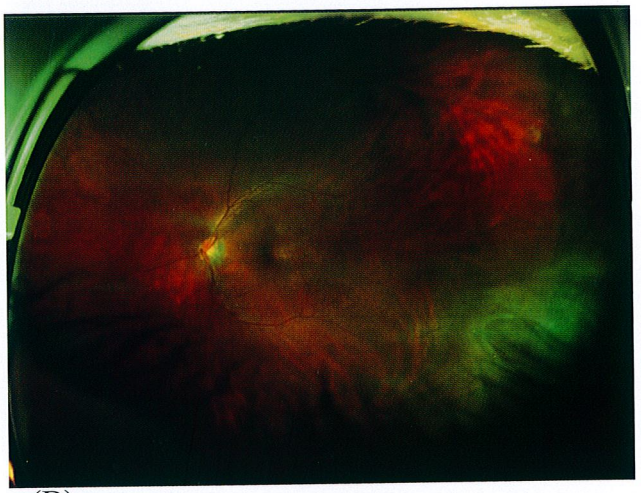
Female, age 49, right eye had maculopathy 3 years ago. (+) migraine ,Px came to get reading spectacles.

Refraction:
RE plano 6/60-1 NIPH
LE +0.75DS -0.50DC x110 6/6 Add +2.00DS
Non contact tonometry:
RE 16mmHg LE 15 mmHg @2.07pm

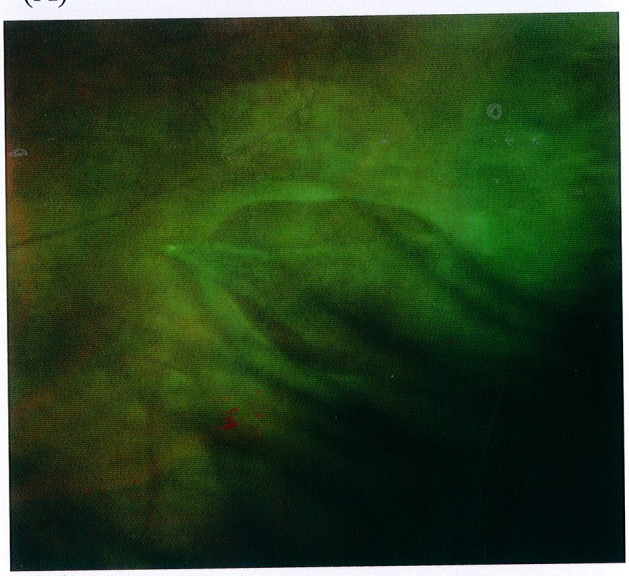
Slit Lamp Van Herrick < 1/4 in both eyes. Since the patient only had one good right eye and she had a history of migraine, she was referred for prophylactic iridectomy to prevent angle closure glaucoma.



(A)



(B)



(C)

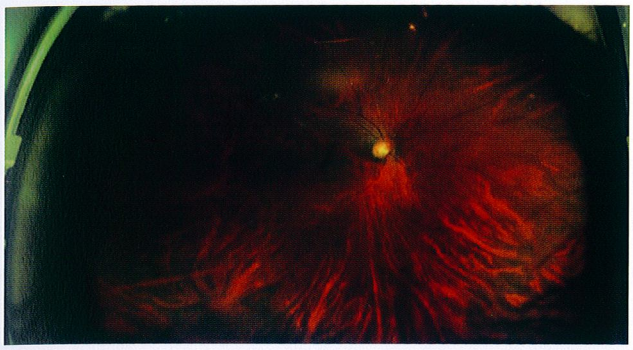
Figure 12:(A) Ultra-wide field fundus photography did not show any abnormality. (B) Ultra-wide field fundus photography showed a horse shoe tear at the temporal inferior peripheral retina. (C) Enlarged view of the horse shoe tear.

Case report 3

Male, 73 yrs. No complaint. Just came to make spectacles. Slit Lamp: Mild cataract in both eyes. IOP (NCT @12.24pm) RE 19mmHg LE 17mmHg

Refraction:
RE -2.25DS/-1.50DC x 80 VA 6/6-2
LE -1.00DS/-1.75DC x95 VA 6/6-2

After seeing the eye doctor, the patient came back to tell me that doctor could not detect any thing wrong and discharged him. I questioned the patient and realized that the eye doctor did not even read my referral memo and did not see the ultra wide field fundus photos. The eye doctor had dilated his eyes and he could because and contacted the eye doctor immediately. Forwarded the horse shoe tear image to him and straight away he realized his negligence. He apologized and asked to see the patient again. The patient immediately went back to him and he performed laser treatment to seal up the horse shoe tear.



(A)

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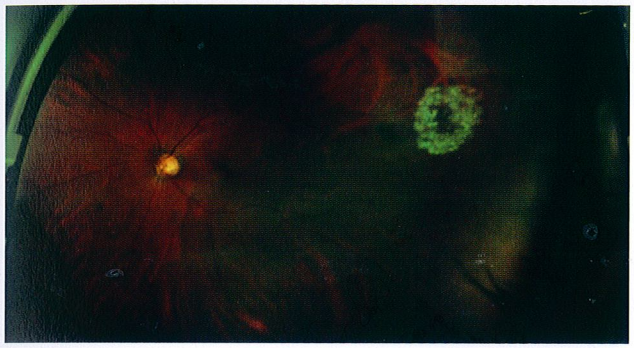


(C)

Figure 13: (A) Ultra-wide field fundus photography of the right eye, showing big cup/disc ratio. Peripheral retina showed no abnormality. (B) Ultra-wide field fundus photography of the left eye showed floater at the optic disc region, big cup/disc ratio and a small retina hole at the temporal peripheral retina. (C) Ultra-wide field fundus photography showing the fresh laser burnt surrounding the hole.

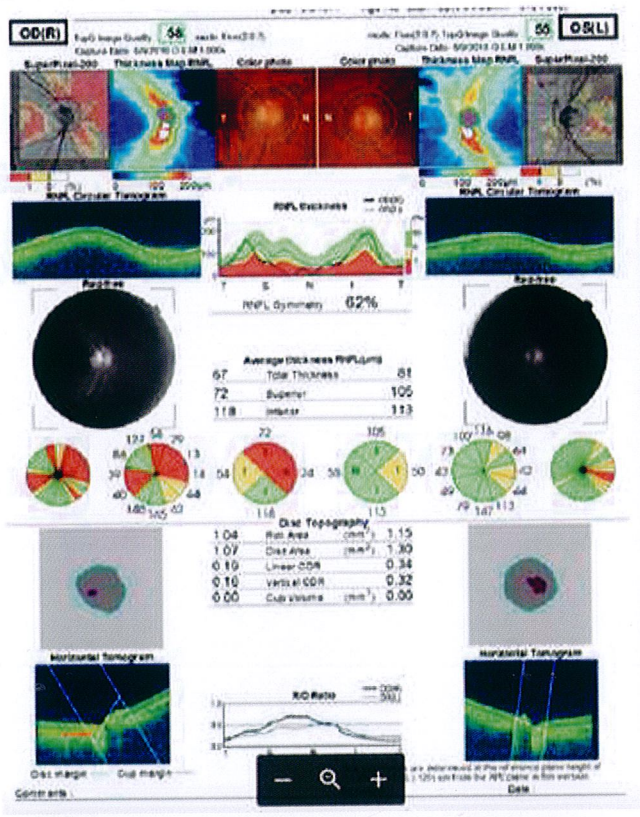
Case report 4

Male, >50 years old. Glaucoma since 2010. 1 drop Xalatan daily.6 monthly checked by eye doctor.

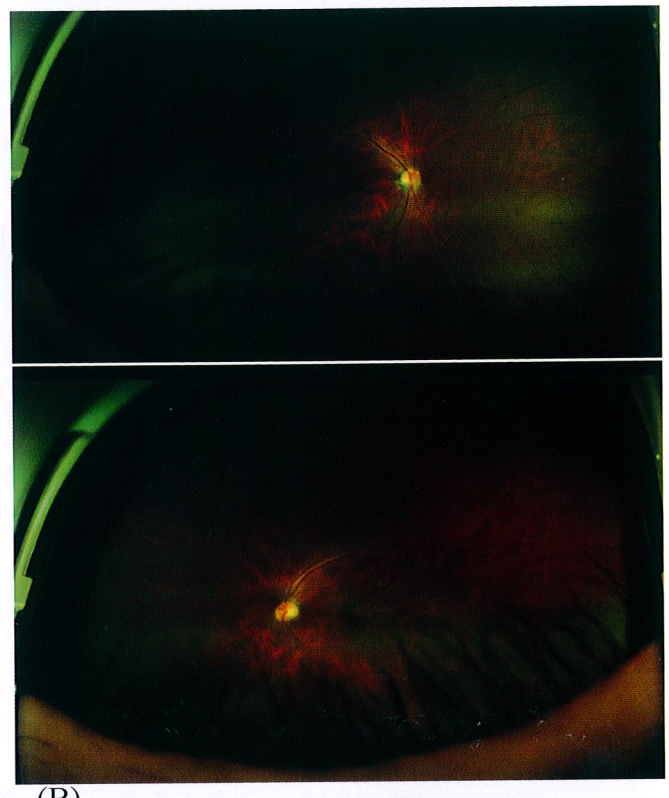
IOP (NCT @ 8.29pm).
RE 16mmHg , LE 17 mmHg

Refraction :
RE -3.50DS -1.00DC x 85 6/6
LE -4.25DS -0.75DC x 90 6/6
Near Add +2.25DS

I was perplexed that this patient's peripheral retinal hole was not picked up by the eye doctor who examined him every 6 monthly for glaucoma. The patient was referred straight away, and he was treated with laser.



(A)



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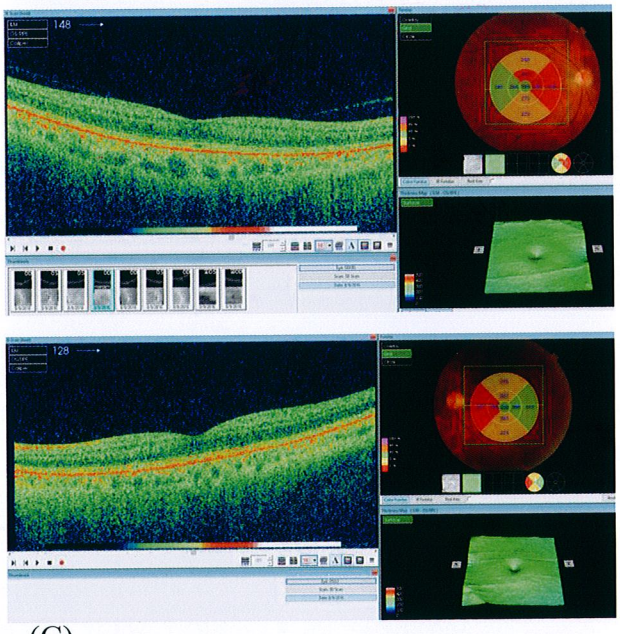
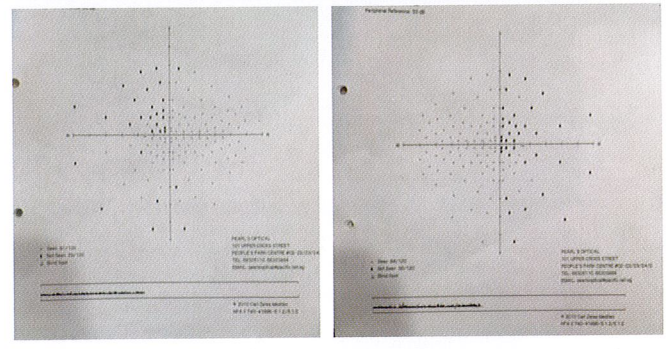


(C)



(D)

Figure 14: (A) RNFL analysis of both eyes showed abnormality on the right eye even though the cup disc ratio was less than 0.3. (B) Ultra-wide Field fundus photography did not show anything wrong in both eyes. (C) OCT scan did not show any abnormality. (D) Perimetry – full field screening showed bi-temporal field defect. The right eye was more serious than the left eye.

Case report 5

Male, 45 yrs, complaint of blur distance vision with spectacle

Refraction

RE -3.25DS -1.00DC x 5 VA 6/30
LE -4.50DS -1.50DC x 170 VA 6/6

Tonometry (NCT@1.48pm)

RE 20mmHg LE 21mmHg

The patient was referred for pituitary adenoma. He was treated and the tumor was removed surgically.

Conclusion

Diagnostic eye drops are still critical for optometrists to perform primary eye care. It is cost effective, and it gives pride to the profession. Primary eye care can still being performed effectively in a shorter period of time if optometrists willing to invest in latest diagnostic instruments. Diagnostic eye drops coupled with modern technology can enable optometrists to perform primary eye care effectively.

Reference

1. Medina, F. J. L., Callén, C. I., Rebolleda, G., Muñoz-Negrete, F. J., Callén, M. J. I., & del Valle, F. G. (2012). Use of nonmydriatic spectral-domain optical coherence tomography for diagnosing diabetic macular edema. American journal of ophthalmology, 153(3), 536-543.

2. Hee, M. R., Izatt, J. A., Swanson, E. A., Huang, D., Schuman, J. S., Lin, C. P., ... & Fujimoto, J. G. (1995). Optical coherence tomography of the human retina. Archives of ophthalmology, 113(3), 325-332.

3. Darma, S., Kok, P. H., Berg, T. J., Abràmoff, M. D., Faber, D. J., Hulsman, C. A., ... & Verbraak, F. D. (2015). Optical density filters modeling media opacities cause decreased SD-OCT retinal layer thickness measurements with inter-and intra-individual variation. Acta ophthalmologica, 93(4), 355-361.

4. Giani, A., Cigada, M., Choudhry, N., Deiro, A. P., Oldani, M., Pellegrini, M., ... & Staurenghi, G. (2010). Reproducibility of retinal thickness measurements on normal and pathologic eyes by different optical coherence tomography instruments. American journal of ophthalmology, 150(6), 815-824.