NEW HORIZONS IN FUNDUS IMAGING

Enhancing reliability, quality, and workflow efficiency with the NW500 non-mydriatic retinal camera

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Fundus camera systems have continued to evolve over the decades with the introduction of advances allowing for non-mydriatic and wide-field capture, and providing higher quality images that enable accurate diagnosis and optimal follow-up. Topcon Healthcare, a leading manufacturer of diagnostic solutions for eye care, has always been at the forefront of innovation in this field, and the company's commitment to developing new technology that can enhance patient care and practice efficiency is once again apparent with its newest fundus camera, the NW500.

When deciding to acquire a new fundus camera, the system's ability to produce sharp, detailed images with true colors, close to what is observed on BIO examination, is among my primary considerations. I also look at wide-field capability, which enables identification of pathology lurking in the periphery, and speed of capture, which is important for making the imaging session easy for the technician and more comfortable for the patient. After having the opportunity to use the NW500 for a short time in our clinic, I can say that the NW500 easily met these criteria and exceeded expectations.

The NW500 is a non-mydriatic, fully automated retinal camera with a 12-megapixel sensor that captures sharp, high quality images with a single touch, with the option of stereo imaging. It is a robust system with enhanced capability compared to other fundus cameras because it provides evaluable true color images even when the capture is done in ambient light, through small pupils, or in the presence of appreciable media opacity.

With an angle of view of 50°, the NW500 can capture a wider area of the retina compared to other models. In addition, the NW500's peripheral photography mode has nine internal fixation positions available, making it possible to create a wide panorama image (approximately 90° angle of view) without loss of detail. Because of its reliable performance, ease of use, and other features, the NW500 also enables workflow efficiency.

A state-of-the art system

The NW500 is engineered with unique slit-scanning technology that provides capture of high-quality images in well-lit rooms and through small pupils. It uses LEP (laser excited phosphor) and LED (light emitting diode) light sources that give consistent, bright illumination needed for acquiring high-quality retinal images with enhanced color fidelity. With Topcon's slit-scanning technology, illumination enters the eye as a narrow slit that is scanned over the desired area in a top to bottom motion while the illuminated area is captured by the camera's rolling shutter mechanism. The slit illumination plays a major role in allowing image capture through small pupils of 2.0 mm. The thin slit illumination reduces backscattering of light that occurs with conventional cameras and is the cause of flare, shadows, and blurred, hazy images.

Impressive initial experience

The following cases demonstrate how imaging with the NW500 enhances diagnostic ability and overcomes the limitations of other camera systems.

The excellent clarity, sharpness, and color fidelity of images acquired using the NW500 are appreciated in images from a patient who presented with bilateral retinal atrophy and with vitreomacular traction (VMT) and an epireti-

Figure 1. *NW500 fundus images show bilateral retinal atrophy (A,B) and retinal thickening from an ERM and VMT OS (B).*

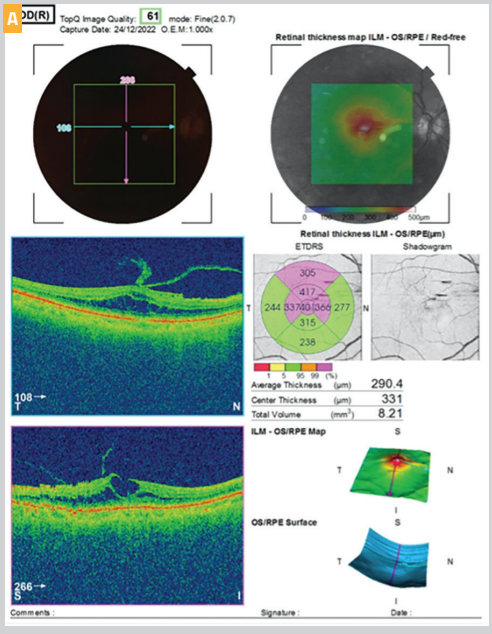

Figure 2. *The OCT report (A) and NW500 image (B) from an eye with an ERM and VMT.*

nal membrane (ERM) in the left eye (Figure 1). Because of the true colors in the NW500 images, the area of thin retina in the left eye is easily distinguished by its color difference when compared to adjacent thickened tissue.

Figure 2 shows the OCT report and NW500 images from another eye with an ERM and VMT. I have been frustrated in the past when pathology identified on OCT was not able to be captured, documented, and recorded with other fundus camera systems. A pseudohole and mild wrinkling of the macula in this eye are clearly evident zooming in on the NW500 image. These findings may also not be picked up easily on clinical exam.

Figure 3 shows images from a patient with age-related macular degeneration (AMD), intraretinal swelling, and areas of atrophy that were detected on OCT. Areas of hemorrhage were also visible in the close-up view of the NW500 fundus image from the left eye.

A case involving a teenager seen on referral further highlights the quality of the NW500 images and their impact on patient care. The teen was complaining of headaches, and suspicion for papilledema was raised based on the appearance of the optic disc in a slit-lamp image taken with a 90 D lens. The patient was determined to have pseudopapilledema based on review of the NW500 images (Figure 4). Thus, he was spared further diagnostic workup with magnetic resonance imaging to rule out papilledema.

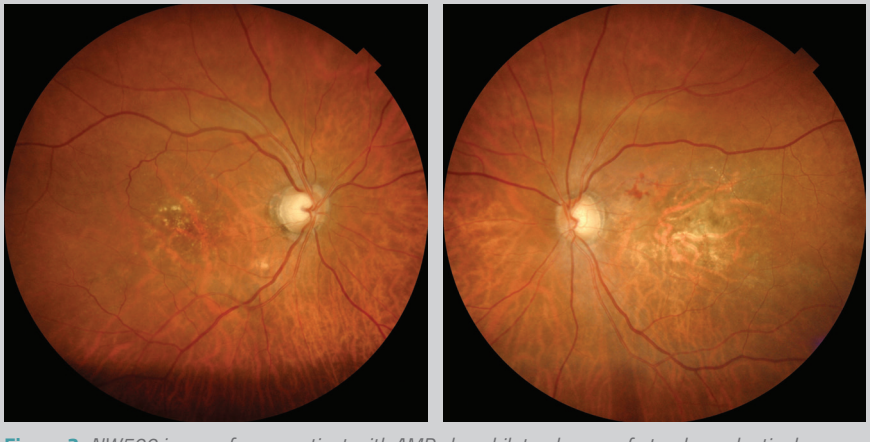

Figure 3. *NW500 images from a patient with AMD show bilateral areas of atrophy and retinal hemorrhage OS.*

Images from a patient with diabetic retinopathy also demonstrate the exceptional clarity and color accuracy of NW500 photographs (Figure 5). The different pathologic features associated with diabetic eye disease (eg, dot/blot hemorrhages, cotton wool spots and hard exudates) are clearly showcased. Serial images obtained before and one week after the patient underwent laser photocoagulation for diabetic retinopathy, highlight the reproducibility and consistency of colors generated with NW500 photography. This performance combined with the sharp quality of the images (note the greyish white laser scars and evidence of resolving hemorrhage in the post-laser image), empowers clinicians as we make management decisions based on monitoring for changes.

With wide-field capability from the software's auto-montage feature, imaging with the NW500 can also pick up findings of diabetic eye disease that might be missed using conventional color fundus cameras for 7-standard field photography. Of course, the NW500 does not take the place of a dedicated wide-field system for imaging the peripheral retina because it does not capture the extreme periphery. Nevertheless, the NW500 gives a good picture of the retina up to the mid-periphery (Figure 6), which may obviate the need for additional imaging in some patients.

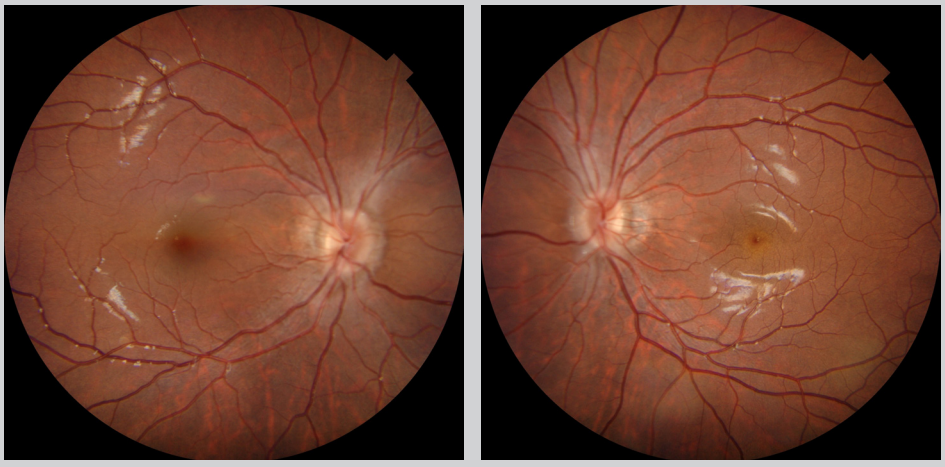

Figure 4. *A diagnosis of papilledema suspected based on slit-lamp imaging was ruled out on review of NW500 images.*

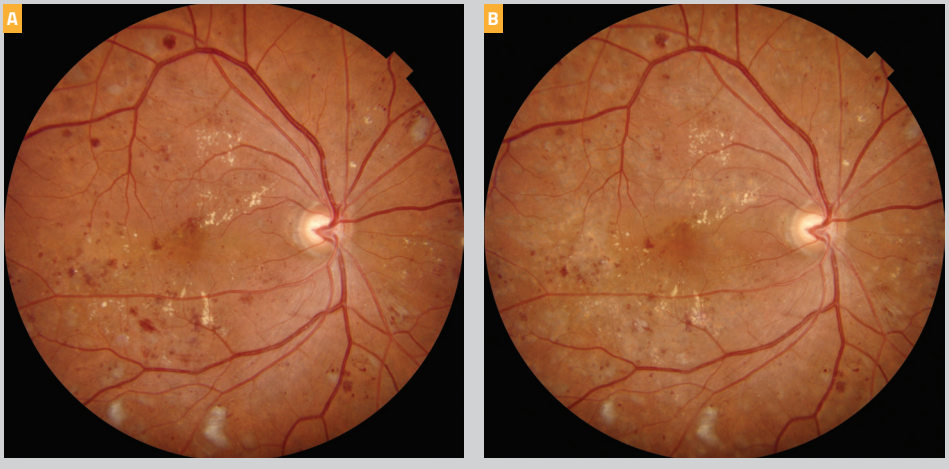

Figure 5. *NW500 images from a patient with diabetic retinopathy showing dot/blot hemorrhages, cotton wool spots, and hard exudates. Photographs taken before (A) and 1 week after laser photocoagulation (B), document the reproducibility and consistency of colors achieved with NW500 imaging and show light photocoagulation burns post-treatment.*

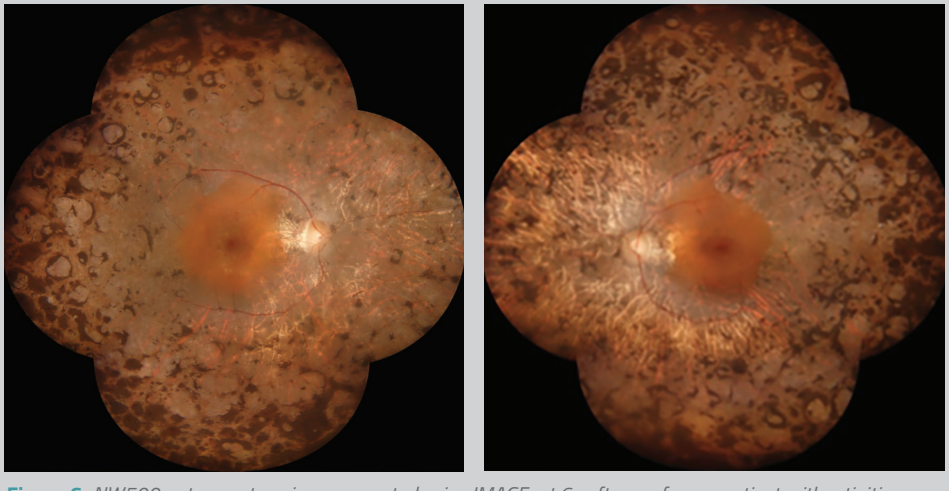

Figure 6. *NW500 auto-montage image , created using IMAGEnet 6 software, from a patient with retinitis pigmentosa*

Imaging through media opacity and small pupils

Due to limitations of the penetrance of light in the visible spectrum, no fundus camera system is able to obtain clear images of the posterior pole in eyes with very dense media opacities. Yet even moderate media opacities can be an obstacle to obtaining good images with some fundus cameras. Because of its slit-scanning technology that reduces backscattering, the NW500 is able to document pathology in the posterior pole, in the presence of moderately dense media opacity, as illustrated in an image from an eye with a NS 2+ cataract and AMD (Figure 7). Identifying existing macular pathology is essential in the preoperative evaluation of patients needing cataract surgery. Again, it can be frustrating when OCT imaging identifies pathology and it cannot be documented in images obtained using other fundus cameras.

Images from a pseudophakic patient with bilateral small pupils (2.0 mm) show the ability of the NW500 to image through miotic pupils (down to 2.0 mm in diameter) (Figure 8A-C). The right eye appeared normal, but a thin ERM with a pseudohole is seen in the NW500 image of the left eye (Figure 8B), and these findings were confirmed on OCT (Figure 8C).

Increasing clinic efficiency

In addition to its imaging capabilities that enable optimal patient care, the NW500 provides value through its effect on workflow efficiency.

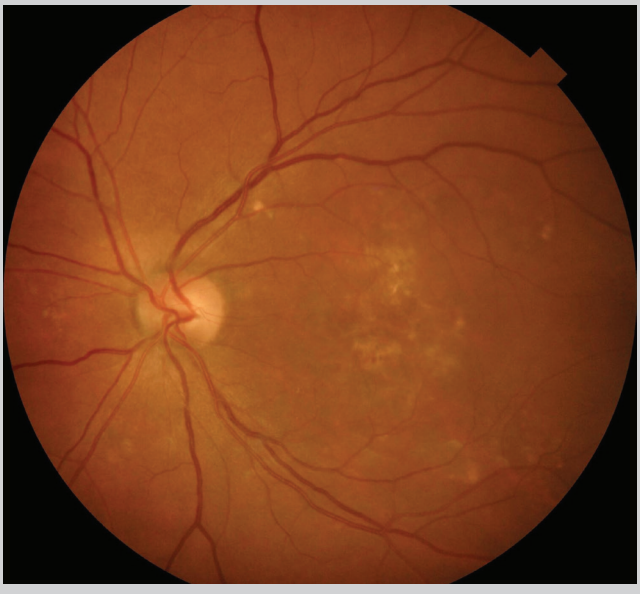

Figure 7. *NW500 image from an eye with NS+2 cataract shows retinal pigment epithelial changes and drusen in this patient with AMD.*

Its abilities to image through small pupils and in lighted conditions, translate into time-saving benefits. Reliably consistent generation of high-quality images by the NW500 also means there is reduced need for recapture. Furthermore, imaging is completed quickly. The NW500 is equipped with auto-alignment, auto-focus, and auto-shoot features, movement of the optical head from first to second eyes occurs automatically without operator intervention, and imaging at different fixation positions is done without the need for obtaining intermediate previews. These functions combined with the system's fast processing speed means that imaging with the NW500 enables clinical workflow efficiency.

Conclusion

If I was asked to describe the greatest assets of the NW500 using just three words I would highlight its speed, consistency, and dependability. Unquestionably, however, the three-word limit fails to encompass the multiple attributes of the NW500 that I believe make it an excellent choice for all busy clinics.

With its ease of use, reduced need for dilating all patients, and fast processing speed, the NW500 has certainly contributed to the smoothness of our daily operations while also making for happier technicians and patients. Most importantly, the ability of the NW500 to reliably capture high-quality, true color images, including in eyes with small pupils and media opacities, makes it a valuable tool for optimizing patient care.

Dr Cheng has no relevant financial interests to disclose.

Figure 8. *Imaging with the NW500 in an eye with a 2.0 mm pupil (A) revealed a thin ERM with a pseudohole (B); these findings were confirmed on OCT (C).*