In the last two decades, advances in ophthalmology and visual sciences have occurred in leaps and bounds. There are new treatment modalities and different diagnostic management for specific conditions necessitating expensive lasers and other equipment. These advances coincided with innovations in computer imaging and software analyses. As the pathophysiology of different eye conditions are better elucidated and the natural course better understood, specific algorithms have been constructed leading to artificial intelligence that provided more objective measures for diagnosis and monitoring. It is appropriate that these innovations be discussed to update the ophthalmic community of their existence and their role in medical practice.

To provide such a forum, many international meetings have included a section on updates in clinical practice that also discusses problems and controversies. These meetings generally synthesize the current trends and problems in ophthalmology, usually ahead of published studies and reports. In recognition of this, we have included a section on updates and controversies that will provide summaries of new developments in any field in ophthalmology and visual sciences and controversies in the diagnosis and management of specific diseases.

The topics included in this issue were recently debated at the 2nd Asia-Pacific Glaucoma Congress held in Hong Kong in September of this year. These topics were discussed by members of the Philippine Glaucoma Society.

Should Anterior Segment Imaging Devices Replace Gonioscopy?

Discussion by Jovell Ian M. Peregrino, MD and Edgar U. Leuenberger, MD

Glaucoma will continue to be the leading cause of irreversible blindness worldwide.[1,2] A recent meta-analysis done by Tham and coworkers projected an increase of 74% in the total number of people with glaucoma, from 64.3 million in 2013 to 76 million by 2020, and to 111.8 million by the year 2040.[2] With this recent forecast, Asia will have the greatest number of both primary open angle glaucoma and primary angle closure glaucoma (PACG), comprising 18.8 million (79.8%) and 9 million (58.4%) respectively.[2] Since half of the world's PACG will come from Asia, an effective reduction in the real incidence and prevention of visual loss from this devastating disease will depend on the accurate assessment of the anterior chamber angle and early detection of appositional closure.[3]

Advances in imaging technology make it possible to visualize and analyze the anterior segment structures including the angles in an objective manner. Proponents claim that anterior segment imaging devices show reproducible and reliable measurements contributing to a sound diagnosis. Given this modern-day reality, will gonioscopy become obsolete?

Yes, anterior segment imaging can replace gonioscopy.

The kind of goniolens used and the amount of visible light greatly affect the accuracy of gonioscopy. For instance, a Goldmann-type lens has a diameter that is larger than the cornea; as such, inadvertent application of pressure on the limbus or central cornea can alter the angle morphology and appearance with a resultant risk of non-detection of narrow angles.[3,4] Leaving the room lights on and allowing the slit-lamp light to constrict the pupil can make narrow angles look more open. Furthermore, gonioscopy is skill-dependent and is interpreted using several angle-grading schemes.[5,6] Not surprisingly, such variables make room for inconsistencies, disagreements, and ultimately, confusion among clinicians. Lastly, as gonioscopy requires corneal contact, it poses a higher risk of infection and accidental corneal abrasion leading to heightened stress and anxiety among patients.

In contrast to gonioscopy, several imaging

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modalities can image the anterior chamber angle at a higher resolution and deeper penetration. These include the Eyecam by Clarity Medical Systems, ultrasound biomicroscope (UBM), anterior segment time-domain optical coherence tomography (TD-OCT) Visante by Carl Zeiss Meditech, spectral-domain optical coherence tomography (SD-OCT) RTVUE by Optovue, Spectralis by Heidelberg Engineering, and lastly, the swept-source optical coherence tomography (OCT) Casia by Tomey.[6]

The Eyecam, which was originally designed for imaging pediatric fundi with posterior segment diseases, was modified to allow for high-quality direct and colored images of the angles.[3] It provides panoramic visualization that correlates well with gonioscopy in angle closure detection, making it also a good learning tool for patients.[7]

The UBM acquires real-time images of the eye at a high frequency of 50 MHz. It has axial and vertical resolutions of 50 and 25 um respectively, and can penetrate through opaque media and structures. Hence, it is possible to visualize the anterior segment even in the presence of dense corneal opacities. Another advantage of the UBM over gonioscopy is that it allows examination of structures behind the iris, such as the ciliary body and zonules. As such, mechanisms of angle closure such as pupillary block, plateau iris, and iridociliary cyst can be justified with a high degree of certainty.[3,5,6,8]

Anterior segment OCT (AS-OCT) uses low-coherence interferometry to measure the delay and intensity of light reflected from tissue structures, and includes both TD-OCT and SD-OCT. Of the two, the SD-OCT captures images at a faster scanning speed of 26,000 to 40,000 A-scans per second with an axial resolution of 5um. The TD-OCT has an axial resolution of 18um at 2,000 A-scans per second. In contrast to gonioscopy where visible light is needed to visualize the angles, the AS-OCT allows evaluation of the degree of iridotrabecular contact both in the presence or absence of light.[3,5,6,9] It is also useful in monitoring the clinical outcomes of goniosynechialysis and laser iridectomy or iridoplasty procedures. A strong point of the Casia swept-source OCT is its ability to provide a panoramic image of the angles, which facilitates measurement of the degree of peripheral anterior synechiae involvement.[10] Non-contact quantitative and qualitative measurements of the angles and anterior chamber depth are taken via built-in software with the patient in an upright position, making for a fast and easy procedure.[3] In a study by Sakata and associates, gonioscopy paled in comparison to the TD-OCT in the detection of closed angles, especially in the superior and inferior quadrants.[11]

No, gonioscopy is still indispensable.

Despite advances in anterior segment imaging, gonioscopy continues to hold its place as the preferred reference standard for assessing anterior chamber angle configuration and structures. This is largely due to its unique application in differentiating appositional from synechial closure through indentation gonioscopy.

Unlike anterior segment imaging devices, gonioscopy also allows the clinician to detect angle neovascularization, abnormal pigmentation, ghost cells, iridodialysis, hyphema, and angle recession in a manner that is quick, convenient, and inexpensive.[6]

The imaging devices discussed earlier have a downside in comparison to gonioscopy. The Eyecam can only acquire qualitative measurements and may have difficulties discerning angle structures if the trabecular meshwork is lightly pigmented. It is inconvenient, requires the patient to be in a supine position, requires more office space, and is expensive. Furthermore, the bright light used during the procedure may alter the normal behavior of the angles.[3,6] The UBM is operator-dependent, inconvenient, with the patient in supine position, and has the discomfort of a saline bath in contact with the cornea with additional risk for abrasions and infection.[3,5,6,8] The saline bath may also cause inadvertent indentation that may alter the image of the angles. Lastly, AS-OCT has limited visualization of the structures posterior to the iris.[3,5]

CONCLUSION

Anterior segment imaging has been upgraded by new devices with advanced technology that ensure objectivity, reproducibility, rapid image acquisition, image storage, and quantitative analysis, even through opaque corneas. However, each device has its own limitations that need to be addressed. Gonioscopy remains to be the standard for anterior chamber examination when done with proper skill and knowledge. Both old and new devices serve patients best as complementary learning and management tools, especially in challenging cases.

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Should Slow-release Glaucoma Medications Replace Eye Drops?

Discussion by Patricia M. Khu, MD, MS

Instilling glaucoma eye drops has been the mainstay in glaucoma management for many years, be it as initial treatment or as adjunct to laser or filtering surgeries. There are different classes of glaucoma eye drops, with different mechanisms of action to lower the intraocular pressure (IOP), either by improving the outflow facility or by suppressing the aqueous production, singly or as combination therapy. Many of these eye drops can lower the IOP by as much as 35% when given either once or twice a day. Successful treatment outcomes for chronic diseases such as glaucoma, however, require daily use of glaucoma eye drops to minimize disease progression.

To maximize the efficacy of glaucoma eye drops and achieve a high concentration inside the eye requires correct placement of the drop onto the eye, the correct number of administration per day, and the correct time interval between multiple dosing of multiple medications. It also requires diligence and manual dexterity, which many patients find challenging.

Topical eye drops penetrate the cornea but less than 1% reaches the aqueous.[1] Hence, many with glaucoma require multiple eye drops, especially those with advanced disease that necessitate much lower target IOPs. Glaucoma drops also have ocular and systemic side effects that increase with more frequent instillation. Because of the side effects and the inconvenience of frequent instillation, compliance to the prescribed regimen suffers. Moreover, diseases that are asymptomatic, such as glaucoma, are more prone to poor patient adherence and persistence.[2-4] And patients with poor glaucoma medication adherence have been shown to have a higher rate of visual loss.[5,6]

Adherence is a measure of the degree to which the patient followed the prescribed instructions during a defined time period.[2] For prostaglandin that is instilled once a day, the adherence rate over time was 70%; and for medications with twice a day dosing, 54%.[2-4] Persistence, on the other hand, is a measure evaluating the time until the patient first discontinued the use of the eye drop.[2] Several studies have shown that persistence with initial glaucoma medications was as low as 33% to 39% at 1 year.[2-4]

A successful glaucoma management requires minimizing IOP fluctuations and flattening the diurnal curve over the long term. What are, therefore, some of the factors that can cause fluctuating IOPs? Varying efficacies of different medications and their bioavailability inside the eye, specifically to the target site, can cause variable IOPs throughout the day. Improper instillation techniques can also reduce the ocular bioavailability and increase the incidence of systemic side effects. Prolonged fluctuating IOPs or the inability to flatten the diurnal curve over the long term can lead to disease progression.[5-7]