

An Evaluation of Ultrasonic Pachymeters

Assistance in selecting a unit.

BY LEON W. HERNDON, MD

Applanation tonometry has been considered the gold standard for determining IOP for almost 50 years. This technique is less likely than Schiøtz tonometry to be influenced by variables such as scleral rigidity.¹ Although, in his landmark article,² Goldmann discussed the influence of variable central corneal thickness on IOP as measured by applanation, he believed that significant variations in central corneal thickness occurred only rarely.

After an optical pachymeter became commercially available, researchers found a positive correlation between central corneal thickness and IOP as measured by applanation.³ This relationship has been confirmed in animal and human studies in which investigators performed intraocular cannulation to experimentally control IOP.^{4,5}

Recently, the Ocular Hypertension Treatment Study determined that central corneal thickness is a significant risk factor for the progression to primary open-angle glaucoma in ocular hypertensive patients.⁶ This study was the first to prospectively demonstrate that a thinner central cornea predicts the development of primary open-angle glaucoma. Due to the newfound importance of central corneal thickness on IOP measurements, pachymetry measurements are rapidly becoming the standard of care for patients with glaucoma and glaucoma suspects. This article provides an overview of the technology.

ULTRASOUND

Ultrasonic pachymetry has largely replaced optical pachymetry, because ultrasound units are easy to use and accurate. Comparing the two types of pachymeters, Salz et al⁷ found that the optical pachymeter had two to three times as much intrasession variability as the ultrasound pachymeters. To assess the reproducibility of central corneal thickness measurements by means of ultrasonic pachymetry, Miglior et al⁸ conducted a study in which 51 volunteers completed three sessions of these measurements. The researchers found that measuring central corneal thickness by ultrasonic pachymetry was highly reproducible.

“The newfound importance of central corneal thickness ... [means] pachymetry measurements are rapidly becoming the standard of care for patients with glaucoma and glaucoma suspects.”

CHOOSING A PACHYMETER

When on the lecture circuit, I am frequently peppered with questions on the use of the different ultrasonic pachymeters. Which one is the best value for the money? How reliable are the devices? Are fancy extras necessary? Table 1 provides key data on the most popular commercially available ultrasonic pachymeters. The information comes directly from the manufacturers' product listings.

When selecting a pachymeter, one needs to consider the setting in which the unit will be used. For instance, if multiple offices will use the pachymeter, then a smaller, portable unit would be appropriate. Possibilities include the 55 Pachmate or 550 Pachette 2 (both DGH Technology, Inc, Frazer, PA), the Pocket II Precision Pachymeter (Quantel Medical, Bozeman, MT), and the Corneo-Gage Plus (Sonogage, Inc., Cleveland, OH). I have taken the 550 Pachette 2 on research trips to Ghana, West Africa, and have had no trouble with its transportation or durability.

Accuracy

All of the devices reviewed in this article seem to offer similarly excellent accuracy in pachymetry measurements. In 1992, Wheeler et al⁹ compared the accuracy and reproducibility of the Pach-Pen (Bio-Rad, Santa Ana, CA) and the DGH 1000 (DGH Technology, Inc.) and found the Pach-Pen to be more accurate, with measurements within 3 to 65 μ m of the true corneal thickness. Intraobserver reproducibility was excellent with both pachymeters. Recently, McLaren et al¹⁰ compared measurements of central

TABLE 1. AN OVERVIEW OF ULTRASONIC PACHYMETERS*									
Manufacturer		Model	Dimensions (Inches)	Weight		Accuracy (µm)	Power Source	Unique Features	List Price
Accutome Ultrasound Malvern, PA (800) 979-2020 www.accutome.com		Advent Pachymeter	4.25 (h) x 13.75 (w) x 15.00 (d)	15 lbs		±5	AC-operated	Newly designed, 55°-angle probe ensures greater visibility under surgical microscope. Voice-Audible Pachymetry mode.	\$6,795
		Pachymeter IV	2.5 (h) x 9.5 (w) x 8.5 (d)	3 lbs		±5	AC-operated	Audible tone definition. Foot-pedal control or continuous-read option.	\$2,995
CBD/Tomey Phoenix, AZ (888) 449-4045 www.tomeyusa.com		SP-3000	10.8 (h) x 8.7 (w) x 8.7 (d)	8.8 lbs		±5	AC-operated	Color LCD touch screen. Built-in printer. Tone-assisted measurement.	\$3,995
		AL-3000	9.3 (h) x 11.8 (w) x 8.2 (d)	11.9 lbs		±100 (A-scan), ±5 (pachymeter)	AC-operated	Combined A-scan and pachymeter. Color LCD touch screen. Built-in printer.	\$8,495
DGH Technology Exton, PA (800) 722-3883 www.dghkoi.com		55 Pachmate	6.9 in length	3.6 oz		±5	Battery-powered (two AAA batteries)	Handheld. IOP-correction calculation.	\$2,995
		550 Pachette 2	4.0 (h) x 8.0 (w) x 9.0 (d)	4 lbs		±5	AC-operated	Desktop model.	\$2,795
Nidek, Inc. Fremont, CA (800) 223-9044 www.nidek.com		EchoScan US-1800	8.0 (h) x 12.3 (w) x 10.3 (d)	13.2 lbs		±5	AC-operated, 115 V	Portable unit with high-speed accuracy. Has pachymetry and ultrasound capabilities. Features IOL power-calculations software.	\$8,500
Quantel Medical Bozeman, MT (888) 660-6726 www.quantelmedical.com		Pocket II Precision Pachymeter	1.6 (h) x 7.9 (w) x 4.0 (d)	16 oz		±5	Battery-powered (four AA batteries) or AC-operated	Portable, fits in lab coat pocket. Automatic averaging with standard deviation; measurement range of 200 to 999 µm.	\$2,495
Sonogage, Inc. Cleveland, OH (800) 798-1119 www.sonogage.com		Corneo-Gage Plus	6.75 (h) x 13.73 (w) x 8.50 (d)	5 lbs		±0.4	Rechargeable battery	White probe. Battery level indicator. 50-MHz high-frequency transducer.	\$2,750
*Not a complete list of available units.									

corneal thickness with the DGH 1000 and the Sonogage devices and found good agreement between the two.

Price

The cost of the pachymeters reviewed ranges from \$2,495 to \$8,500. Now that procedural reimbursement is available from most insurance carriers, the purchase of one of these units has become more affordable.

Bells and Whistles

The more expensive units have features that may be useful in select cases. The Advent Pachymeter (Accutome Ultrasound, Malvern, PA) has a 55°-angle probe that may allow for greater visibility under the surgical microscope. This unit’s voice-audible mode might be a boon in the OR. The built-in printers with the SP-3000 and AL-3000 units (both from CBD/Tomey, Phoenix, AZ) would be helpful in cases where the accurate compilation of pachymetry measurements is necessary.

CONCLUSION

The Ocular Hypertension Treatment Study showed that measuring central corneal thickness is crucial to assessing a patient’s risk for glaucomatous progression. Other studies now show the importance of measuring central corneal thickness in established glaucoma as well to further stratify patients’ risk.¹¹ A number of accurate, durable ultrasonic pachymeters are available that will allow the practitioner make this important calculation. □

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