



MEIBOGRAPHY 101



How to capture and interpret images to determine meibomian gland health.

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Tear film homeostasis is essential for the maintenance of a healthy ocular surface. There needs to be a perfect balance between the mucous/aqueous layer and the lipid layer of the tear film.¹ The lipid layer comes from meibum that is secreted onto the ocular surface from the meibomian glands, which are located between the palpebral conjunctiva and the tarsal plate of the upper and lower eyelids.²

In 2011, the Tear Film and Ocular Surface Society's International Workshop on Meibomian Gland Dysfunction (MGD) defined MGD as "a chronic, diffuse abnormality of the meibomian glands, commonly characterized by terminal duct obstruction and/or qualitative/quantitative changes in the glandular

secretion. It may result in alteration of the tear film, symptoms of eye

irritation, clinically apparent inflammation, and ocular surface disease."³ This was a pivotal point in dry eye disease management, as the focus shifted from aqueous deficiency to evaporative disease.⁴

EARLY MEIBOGRAPHY

Meibography was first described in 1977 by Tapie⁵ as specialized imaging to capture the morphology of the meibomian glands in vivo.² Over the past 4 decades, imaging of meibomian gland morphology in vivo has changed significantly. Innovations in technology have

AT A GLANCE

- ▶ With the cost to acquire new technology now within reach for most clinicians, the standard of care for dry eye evaluations and screening patients should include meibography imaging to document gland structure and monitor for change over time.
- ▶ Once a good quality meibography image has been captured, three standardized grading scales can be evaluated: gland atrophy, gland tortuosity, and gland segmentation.
- ▶ In some settings, meibography screening is performed in much the same way as assessing IOP and is not billed to the patient, while other settings have a screening fee set by the practice.

Figure courtesy of Heiko Pult, PhD, MSc, HonVis.

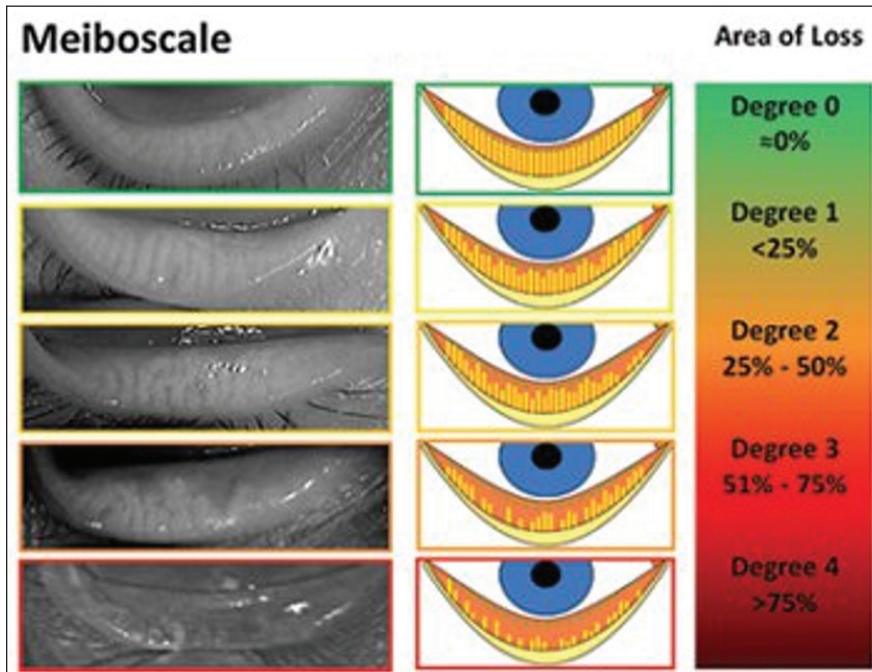


Figure 1. Pult 5-grade scale for meibomian gland atrophy.

allowed us to easily integrate meibography into the clinic setting and to be easily captured during the patient examination with minimal time constraints.

In 2008, Arita et al introduced a noncontact form of meibography to capture images at the slit lamp by using infrared (IR) filters without the use of transillumination and a handheld light source.⁶ This technique improved not only image quality, but also patient comfort during imaging.

Traditional IR meibography is expanding to laser confocal meibography, OCT meibography, anterior segment photography, and meibomian gland clearing treatment device imaging. With the cost to acquire new technology now within reach for most clinicians,

MEIBOGRAPHY OPTIONS

Below are some examples of available devices and their key features:

TearScience LipiView II Ocular Surface Interferometer (Johnson & Johnson Vision)

- Real-time visualization of lipid layer to evaluate the dynamic response of lipids to blinking
- Uses advanced illumination technology to capture high-definition images

TearScience LipiScan Dynamic Meibomian Imager (Johnson & Johnson Vision)

- Quickly images an eyelid in roughly 10 seconds
- Dynamic illumination offers an enhanced view of meibomian gland structure

Oculus Keratograph 5M (Oculus)

- Advanced corneal topographer with a built-in real keratometer and a color camera optimized for external imaging

Meibox (Box Medical Solutions)

- Portable slit lamp-mounted, cloud-based infrared non-contact camera
- Captures images of the external images of the eye, including meibomian gland structures, in black and white

MX2 (Shaffer Vision Solutions)

- First high-definition, cloud-based external ocular camera and meibographer
- Portable and slit lamp compatible

IDRA Ocular Surface Analyzer (SBM Sistemi)

- Comprehensive diagnostic system for high-quality tear film analysis
- Quick and detailed examinations

LacryDiag (Quantel Medical)

- Offers a complete diagnosis of the three tear film layers, produces images of the meibomian glands, and measures the percentage loss of the meibomian glands
- Performs four noncontact examinations (interferometry, noninvasive tear breakup time, tear meniscus, and meibography) in 4 minutes

HD Analyzer (Keeler)

- Measures objective scatter index of each patient
- Measures total optical quality, accounting for light scatter caused by pathologies

Systane iLux (Alcon)

- Portable
- Visualizes treatment zones to target blocked meibomian glands

Images courtesy of Clare Halleran, OD.

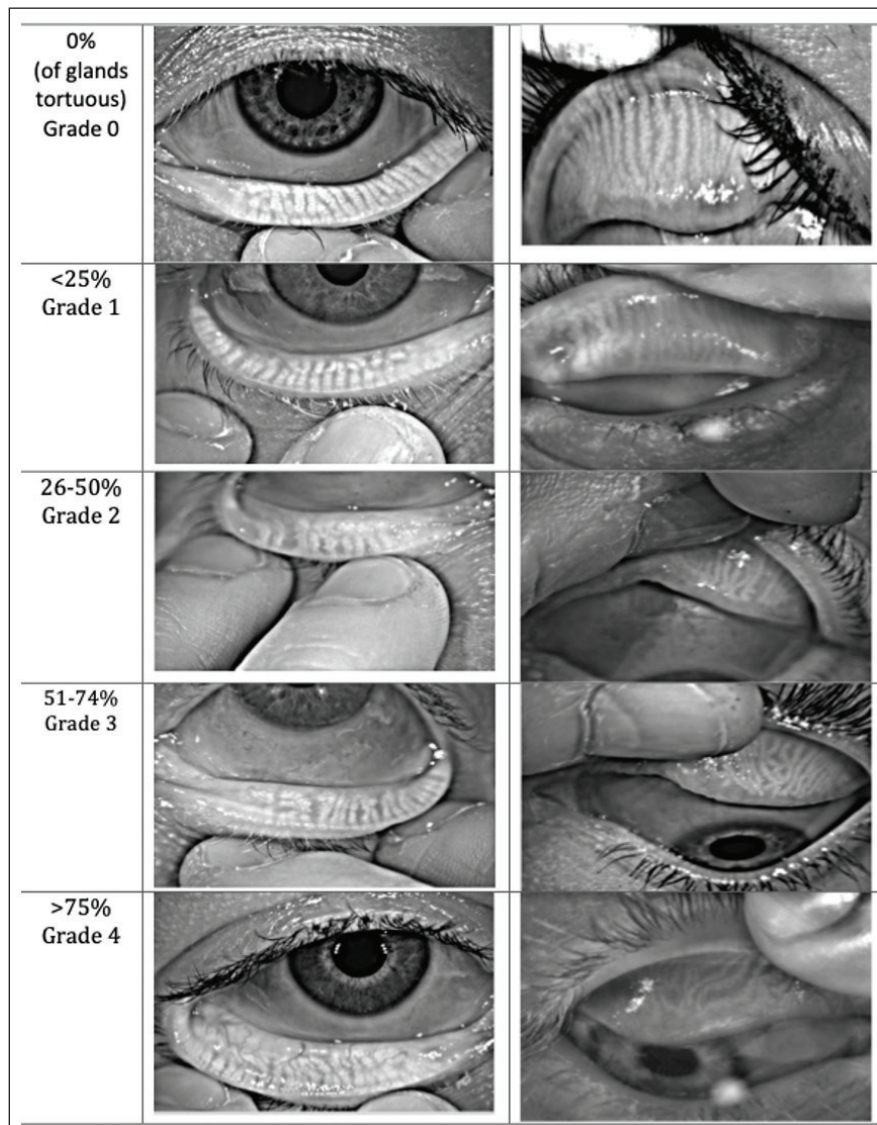


Figure 2. Halleran grading scale for meibomian gland tortuosity.

the standard of care for dry eye evaluations and screening patients should include meibography imaging to document gland structure and monitor for change over time.

CAPTURING AND ANALYZING IMAGES

Capturing noncontact meibography images is only getting easier and is a skill a trained ophthalmic assistant can learn. Depending on the device used (see *Meibography Options*), the bottom eyelid is gently rolled away from the globe with either the handheld device, a cotton

tip, or lid stick to expose the lower palpebral conjunctiva. One should be careful to expose as much of the lower lid as possible to allow for full visualization of the meibomian gland. Imaging superior lids is also performed with the traditional superior lid eversion technique.

Once you have captured a quality meibography image, what do you look for when reviewing the image? There are standardized grading scales by which to evaluate gland atrophy,^{6,7} gland tortuosity,⁸ and gland segmentation.⁹ Meibomian gland grading remains an inconsistent process and

there are interobserver differences among experts in the field that highlight the need for a standardized approach and learning to accurately grade meibography images.¹⁰

With these inconsistencies in mind, Milton Hom, OD; Clare Halleran, BSC, OD; and I set out to standardize a way to analyze meibography images as it pertains to three main characteristics: atrophy, tortuosity, and segmentation. After a training module was implemented, masked graders were asked to regrade a series of images and were found to be more consistent in interobserver grading.¹⁰

Atrophy

Meibomian gland atrophy is a partial loss of the meibomian gland. Arita et al described partial gland as meibomian glands showing “partial loss from the orifice or fornix.”⁶ Partial loss or atrophy should be evaluated by number and length of the patient’s meibomian glands. Gland dropout is evaluated by the number of meibomian glands with complete loss from orifice to fornix (Figure 1).

Tortuosity

Tortuosity is considered present if there is at least one area in the gland that is 45° bent away from the midline, or if there is more than one bend in the gland despite those being bent less than 45°. The Halleran Scale can be used as a point of reference when looking at meibography images for tortuosity (Figure 2).

Segmentation

Segmentation of the meibomian gland is described as a disjointed appearance of the meibomian gland.¹⁰ Segmentation is often seen as a black line splitting the gland, and can be large or very thin. The LEO Segmentation grading scale is a novel approach to grading this finding (Figure 3).

BILLING AND CODING

In some settings, meibography screening is performed in much the

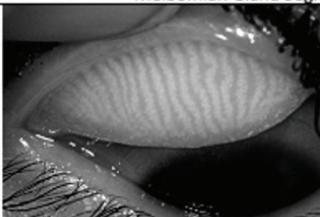
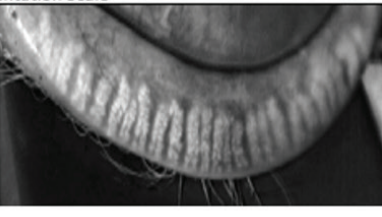
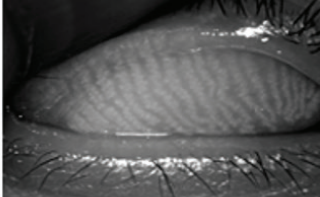
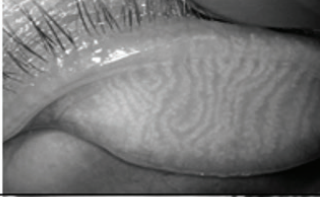
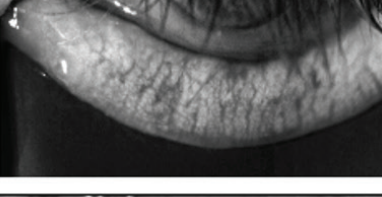
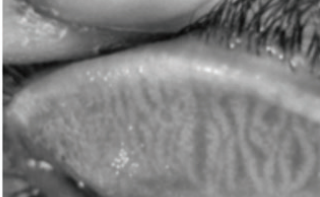
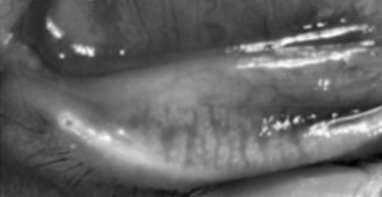
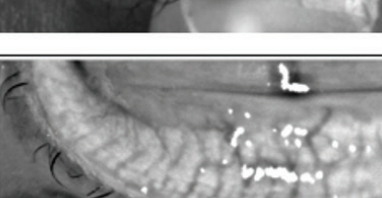
Meibomian Gland Segmentation Scale		
0 (0% Segmentation)		
1 (1-25% Segmentation)		
2 (26-50 % Segmentation)		
3 (51-75% Segmentation)		
4 (>76% Segmentation)		
*Grade based on % of Glands Visible in Image		

Figure 3. LEO grading scale for meibomian gland segmentation.

same way as assessing IOP and is not billed to the patient, while other settings have a screening fee set by the practice. Once changes are detected, images can be captured and billed to the insurance for payment. The CPT codes used for meibography are 92285 for “external ocular photography with interpretation and report documentation of medical progress” and 0507T for “near infrared dual imaging (ie, simultaneous reflective

and transilluminated light) of meibomian glands, unilateral or bilateral, with interpretation and report.” The coding is specific to the type of image captured and whether IR imaging is performed or not. It is good practice to have patients sign an *Advance Beneficiary Notice* to allow for patient payment if a particular insurer does not reimburse the practice for the submitted code and procedure.

MEIBOGRAPHY: A TOOL WE CAN'T PASS UP

With growing numbers of studies suggesting that MGD is prevalent in the pediatric population,¹¹ and gland atrophy correlating with as little as 2 hours daily of screen time,¹² we owe it to the patients we serve to take a proactive approach in assessing their meibomian gland health. Meibography is the imaging modality best suited for this task. It's affordable and has an easy learning curve. ■

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