

# A Current Treatment for Meibomian Gland Dysfunction

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## Key Messages

- Meibomian gland dysfunction is thought to contribute to up to 86% of Dry Eye Disease cases (Lemp et al, 2012)
- The Meibomian glands do not function properly when there is a blockage/obstruction or abnormality in gland structure, leading to a decrease in meibum secretion onto the surface of the eye
- The iLUX® System uses eyelid thermal pulsation to offer optometrists and ophthalmologists a unique and customizable treatment of the signs and symptoms of dry eye associated with Meibomian gland dysfunction

## Introduction

Meibomian gland dysfunction (MGD) is a term that includes several disorders of the glands and can be either acquired or congenital (Chhadva et al, 2017). MGD is 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 (Nichols et al, 2011).

The Meibomian glands secrete meibum, a substance that is crucial to the lubrication and health of the ocular surface. In MGD, changes to the composition or volume of meibum can result in ocular surface damage, tear film evaporation, and inflammation, leading to visual disturbances and ocular discomfort. MGD contributes greatly to dry eye disease (DED), specifically evaporative dry eye disease (Lemp et al, 2012; Chan et al, 2019). A recent global epidemiology report concluded that the prevalence of DED ranges from 5% to 50% (Stapleton et al, 2017) and MGD is thought to contribute to up to 86% of DED cases (Lemp et al, 2012).

## Meibum Production and Secretion and Dry Eye Disease

The Meibomian glands are modified sebaceous, holocrine glands located within the upper and lower eyelids (Figure 1) (Bron et al, 2017). The glands produce meibum that is secreted from the opening of the glands anterior to the mucocutaneous junction on the lid margin. Secretion of the meibum can be passive or partly through expression with the blink mechanism (Bron et al, 2017). The meibum secretion normally exists in a partially liquid-crystalline state at the average corneal temperature of 32°C, with a melting range reported to be between 10 and 40°C). Above 40°C meibum is in a completely liquid state (Butovich et al, 2014; Tomlinson et al, 2011).

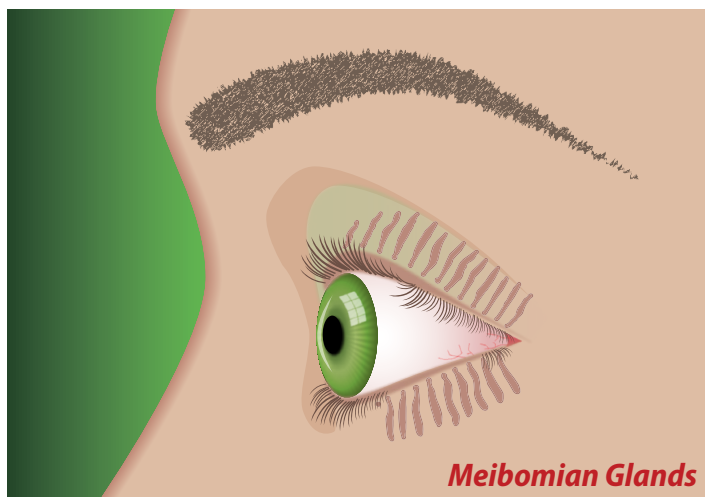


Figure 1: Eye showing placement of Meibomian gland ducts

The meibum is composed primarily of protein and lipids, including polar lipids (amphiphilic lipids and phospholipids) and non-polar lipids (wax esters, cholesterol esters and some triglycerides) which is spread across the surface of the aqueous portion of the tear film with each blink (Foulks and Bron, 2003; Bron et al, 2017). Meibum secretions make up the lipid layer of the tear film (Arita, 2017). The lipid layer self-organizes into a layer of superficial non-polar lipids and polar lipids that anchor it to the mucoaqueous phase of the tear film to help prevent tear film evaporation (Figure 2).

The Meibomian glands do not function properly when there is a blockage/obstruction or abnormality in gland structure, leading to a decrease in meibum secretion onto the surface of the eye. The predominant feature of MGD is epithelial hyperkeratinization of the duct, which leads to meibum accumulation in the duct (Gutgesell, 1982; Bron et al, 2017). The lack of normal lipids secretion results in tear film instability which in turn results in increased tear evaporation and hyperosmolarity. This hyperosmolarity can result in ocular surface damage directly and indirectly, through an inflammatory cascade (Foulks and Bron, 2003; Bron et al, 2017). In MGD, the meibum composition is altered and shows an increased melting point (Butovich et al, 2014). The increased melting points may lead to impaired spreading of meibum lipids and increase tear film evaporation (Willcox et al, 2017).

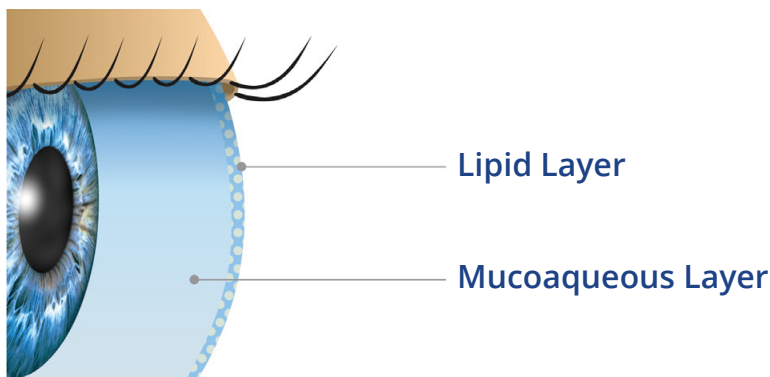


Figure 2: Tear film layers

## Treatment and Management of MGD

To date there is no cure for MGD. Current treatments are aimed at relieving the signs and symptoms of dry eye caused by MGD. Traditional treatments for MGD have included lid hygiene, warm compresses, ocular lubricants, increased intake of omega-3 fatty acids, topical or systemic antibiotics, and anti-inflammatory agents (Geerling et al, 2011). Warm compresses are a frequently used treatment but require repeated daily application to achieve the necessary temperature to melt meibum. However, the techniques recommended to patients vary greatly, in terms of how to achieve the appropriate therapeutic temperature to melt meibum, and the duration and frequency of lid warming and cleansing. Additionally, there is no confirmation of Meibomian gland evacuation during a typical warm compress procedure.

## Eyelid Thermal Pulsation Treatment for MGD

Eyelid thermal pulsation systems are designed to treat the signs and symptoms of MGD by combining heating and evacuating the contents of the Meibomian glands, unlike typical warm compress (heating alone) treatments.

The iLUX® System is a novel eyelid thermal pulsation system indicated for the application of localized heat and pressure therapy in adult patients with chronic disease of the eyelids, including Meibomian Gland Dysfunction (MGD), also known as evaporative dry eye. The iLUX® System uses light-based heat followed by manual compression to melt and express meibum with direct visualization throughout the treatment. The iLUX® System is used to provide an in-office treatment for MGD and has a portable design that allows for the heating of the Meibomian glands and expression of inspissated meibum (Figure 3).

The iLUX® System was cleared for use in the US market in 2017, and the randomized clinical trial (n=142) submitted to the FDA supporting the clearance of the iLUX® System demonstrated clinically significant mean improvement from baseline in the following endpoints: Meibomian gland score (mean change = 17.7), tear break up time (TBUT) (mean change = +2.79s) and Ocular Surface Disease Index (OSDI) score (mean change = -31.0) at 4 weeks (Alcon data on file, CSR). This study also demonstrated substantial equivalence of the iLUX® System to the predicate device, Johnson and Johnson's LipiFlow® Thermal Pulsation System (Hardten, ASCRS 2018). There was a total of four device/procedure-related adverse events reported in the study. All AEs were observed in the iLUX® System arm and consisted of: burning sensation without skin findings (n=2), petechial hemorrhage in lower lids (n=1), and transient decrease in BSCVA with findings of superficial punctate keratitis (n=1) (Alcon data on file, CSR). All were self-limited, transient, and resolved without sequelae. There were no differences in staining, intraocular pressure, and visual acuity between treatment groups (Alcon data on file, CSR).

There are two main components to the iLUX® System: a portable hand-held instrument that houses a magnifier for Meibomian gland visualization and a digital display showing heating time and lid temperature and the gland compression controls. Additionally, there is a single-use sterile Smart Tip patient interface device that contacts the inner and outer lid surface and delivers heat to the Meibomian glands. The patient interface device has microsensors that maintain the temperature of the eyelid between 38-42° C. Among the eyelid thermal pulsation systems, the iLUX® System uniquely measures the eyelid temperature on both the inner and outer surfaces using the Smart Tip. The iLUX® System limits the temperature to a maximum of 44° C and 45° C respectively, unlike the LipiFlow® which has no external eyelid sensor or temperature limit (iLUX® System User Manual).



treatment of about 10 minutes (treating 2 zones per eyelid/both eyes) (Alcon data on file). Once the Smart Tip patient interface device is attached to the hand-held instrument, the treatment begins. With the patient looking up, the lower lid is captured between the outer and inner pad of the Smart Tip and is visualized throughout the treatment. Once the lid is captured, the meibum heating phase of the treatment begins. The iLUX® System display reads how long the inner lid temperature has been above 38° C. Typically melted meibum percolates out of the Meibomian gland orifices onto the lid margin surface between 30-50 seconds after the device reaches 38° C. After approximately 40 seconds or when meibum release is visualized, compression of the Meibomian glands is initiated using the hand-held instrument. Unlike expressing a Meibomian gland without applying heat, inspissated meibum may appear to have a toothpaste like appearance as it is partially expressed. After meibum is heated to its melting point, some of it may release onto the lid margin in a liquid form even before compression of the glands. Typically, the Meibomian glands are compressed 2-5 times for 5 seconds per compression until clear meibum is easily expressed from the gland. A unique characteristic of the iLUX® System among in-office dry eye treatments for MGD management is that direct visualization of the glands during compression allows for customization of the treatment for each patient. The clinician can directly assess if a specific group of glands need additional heat or compression and immediately address the area versus assuming that the glands were successfully opened and evacuated. Two zones (nasal/temporal) may be treated on each of the lower and upper lids with a single Smart Tip patient interface device, however the clinician has the ability to customize the treatment to the specific regions of the eye lid where Meibomian gland blockage is observed.

The iLUX® System offers optometrists and ophthalmologists a unique and customizable treatment of the signs and symptoms of dry eye associated with Meibomian gland dysfunction.



Figure 3: iLUX® System

# Important Product Information about the iLUX® System

## Indication:

The iLUX® Device is indicated for the application of localized heat and pressure therapy in adult patients with chronic disease of the eyelids, including Meibomian Gland Dysfunction (MGD), also known as evaporative dry eye.

## Contraindications:

Do not use the iLUX® Device in patients with the following conditions: Patients whose pupils have been pharmaceutically dilated; patients who have undergone ocular surgery within prior 12 months; patients with ocular injury or trauma, chemical burns, or limbal stem cell deficiency (within prior 3 months); patients with active ocular herpes zoster or simplex of eye or eyelid or a history of these within prior 3 months; patients with cicatricial lid margin disease; patients with active ocular infection, active ocular inflammation or history of chronic, recurrent ocular inflammation within prior 3 months; patients with an ocular surface abnormality that may compromise corneal integrity; patients with lid surface abnormalities that affect lid function in either eye; patients with aphakia; or patients with permanent makeup or tattoos on their eyelids.

## Warnings/Precautions:

Federal law restricts this device to sale by or on the order of a licensed healthcare practitioner. Use of the iLUX® Device is not recommended in patients with the following conditions: moderate to severe allergic, vernal or giant papillary conjunctivitis; severe eyelid inflammation; systemic disease conditions that cause dry eye; in patients who are taking medications known to cause dryness; or patients with punctal plugs.

## Potential Adverse Reactions:

Potential adverse effects may include eyelid/eye pain requiring discontinuation of the treatment procedure, eyelid irritation or inflammation, temporary reddening of the skin, ocular surface irritation or inflammation (e.g., corneal abrasion, conjunctive edema or conjunctival injection (hyperemia)), and ocular symptoms (e.g., burning, stinging, tearing, itching, discharge, redness, foreign body sensation, visual disturbance, sensitivity to light).

**Attention: Please refer to the User Manual for a complete list of contraindications, instructions for use, warnings and precautions for the iLUX® Device.**

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