

OCULOPLASTIC OPTOMETRY

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FINANCIAL DISCLOSURES

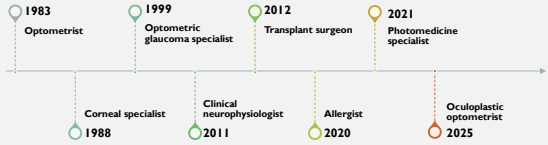
I am an Advisor for MDelite Laser & Aesthetic and this disclosure has been mitigated

I was a consultant to Konan Medical USA during the past 24 months and this disclosure has been mitigated



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"MY MOM IS SO PROUD OF ME"



1983 Optometrist
 1988 Corneal specialist
 1999 Optometric glaucoma specialist
 2011 Clinical neurophysiologist
 2012 Transplant surgeon
 2020 Allergist
 2021 Photomedicine specialist
 2025 Oculoplastic optometrist


Be All The Optometrist You Can Be!

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OCULOPLASTIC OPTOMETRY

Oculoplastic optometry includes a variety of procedures to treat conditions dealing with the eyelids, the tear ducts, and the face

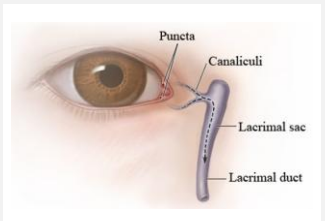
- Lacrimal system probing and irrigation
- Lacrimal system occlusion
- Eyelid margin debridement
- Intense pulsed light therapy
- Low-level light therapy
- Radiofrequency thermal therapy



"Oculoplastic optometrists perform procedures for medical reasons that have can have cosmetic benefits"

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LACRIMAL SYSTEM ANATOMY



Lacrimal Outflow Pathway

- Eyelid margin
- Lacrimal punctum
- Lacrimal canaliculus
- Lacrimal sac
- Nasolacrimal duct

"Drains the tears from the surface of the eye"


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LACRIMAL PUMP MECHANISM

Tears flow along the upper and lower margins of the eyelids and enter the upper and lower canaliculi by capillary action and suction

With each blink, the orbicularis muscle squeezes the puncta and canaliculi together and it also contracts and expands the lacrimal sac, thereby creating negative pressure which sucks the tears from the canaliculus into the sac

When the eyes open, the muscles relax, the lacrimal sac collapses, and a positive pressure is created which forces tears down into the nasolacrimal duct




Failure of the lacrimal pump mechanism results in tears pooling in the conjunctival sulcus until they spill over the eyelid after the blink

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EXAMINATION

The primary goal of the eye examination is to differentiate epiphora from hyperlacrimation

- Patient history
- Ocular examination
- Lacrimal system vital signs
- Nasal evaluation
- Infrared meibography
- Non-invasive tear break-up time
- Tear film osmolarity
- Allergy skin testing



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ABNORMAL TEARING OR "WATERING"

EPIPHORA refers to abnormal tearing or watering of the eyes due to obstruction in the lacrimal outflow pathway

Anatomical lacrimal pathway obstruction hinders tear film drainage because of structural pathology

- Punctal stenosis and obstruction
- Canalicular stenosis and obstruction
- Nasolacrimal duct obstruction

Functional lacrimal pathway obstruction is due to a failure of the lacrimal pump mechanism

- Punctal ectropion
- Eyelid laxity and malposition
- Facial palsy

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ABNORMAL TEARING OR "WATERING"


HYPERLACRIMATION refers to abnormal tearing or watering of the eyes due to reflex irritation of the corneal and conjunctival surface

- Dry eye disease
- Blepharitis
- Ocular allergy
- Corneal epitheliopathy
- Corneal or conjunctival foreign body
- Sleep deprivation
- Environmental factors
- Contact lens-related dry eye disease

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TREATMENT PROCEDURES

- If the diagnosis is epiphora, then the second goal is to differentiate anatomical causes of epiphora from functional causes
- Non-invasive testing to diagnose punctal or post-punctal lacrimal drainage system obstruction
- Dilatation of the lacrimal punctum allows for assessment of functional or mechanical stenosis
- Irrigation of the nasolacrimal drainage system allows for assessment of functional or mechanical stenosis



Dilatation of the lacrimal punctum

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PROCEDURE UTILIZATION STATISTICS FOR 2024


CPT Code	Description	Quantity
68801	Dilatation of the lacrimal punctum, with or without irrigation	6
68810	Probing of the nasolacrimal duct, with or without irrigation	9
68840	Probing of the lacrimal canaliculi, with or without irrigation	43
68530	Removal of foreign body from the lacrimal passages	1
68761	Closure of the lacrimal punctum by plug	225

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BIOFILM

The biofilm is a well-hydrated, multi-laminar matrix of bacteria and their polysaccharide glycoalyx that is used as a defense structure to assist in survival

- Allows bacteria to avoid desiccation
- Allows bacteria to avoid host defense responses on or within other living organisms
- Allows bacteria to produce virulence factors
- Allows bacteria to liberate and concentrate nutrients
- Allows bacteria to communicate across different species



Bacterial Biofilm


Rymeron JF, Perry HD. DEBS: a unification theory for dry eye and blepharitis. *Current Ophthalmology*. 2016;10:245S-246P. doi:10.2147/COPT.S114674

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EYELID MARGIN DEBRIDEMENT

Removal of the bacterial biofilm from the eyelid margin improves the lipid layer of the tear film, removes a source of eyelid inflammation, and allows the lids and glands to begin the healing process

- Patients with meibomian gland dysfunction
- Patients who wear contact lenses
- Patients with chronic conjunctivitis
- Who are about to undergo refractive surgery
- Who are about to undergo cataract surgery



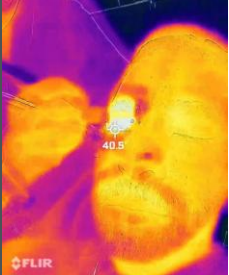
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MEIBUM LIPODOMICS

STUDY OF PATHWAYS AND NETWORKS OF CELLULAR LIPIDS IN BIOLOGICAL SYSTEMS

The effect of temperature on meibum structure is determined by studying the phase transition characteristics of meibum using Fourier transform infrared spectroscopy to follow the order-to-disorder transition

- Conformation is the arrangement of the atoms in a molecule in space
- Order refers to a phase where lipids are in a more solid but not completely gel-like phase
- Lipids are in an ordered state at low temperatures
- When lipids become disordered, they exist in a more fluid, liquid-crystalline phase
- Changes in meibum fluidity are temperature dependent because the conformation of the lipid hydrocarbon chain changes with increasing temperature



Eyelid temperature measured during radiofrequency thermal therapy with FLIR One Pro thermal camera

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MEIBUM LIPODOMICS

STUDY OF PATHWAYS AND NETWORKS OF CELLULAR LIPIDS IN BIOLOGICAL SYSTEMS

- Meibum is not a solid at low temperatures, but exists as a gel phase that is 20% disordered
- Meibum is not a liquid at higher temperatures, but exists in a liquid-crystalline phase that is about 80% disordered
- 'Melting' should not be used to describe the meibum fluidity changes seen in meibomian gland dysfunction since melting is associated with a phase change from solid to liquid
- In vitro and in vivo studies demonstrate that the temperatures required to liquify obstructive secretions range from 32°C to 45°C in mild-to-moderate disease
- 40°C is required for maximum lipid disorder and effective liquefaction in normal patients and 41.5°C is required for patients with severe disease
- It should be noted that heating the meibum just 2.5°C disorders the meibum 66% and sub-optimal temperatures are still effective at disordering the lipids

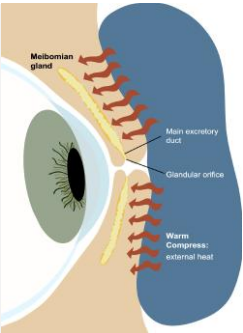
Buchman D. The optimum temperature for the therapy for meibomian gland dysfunction. *The Ocular Surface*. Volume 17, Issue 2 April 2019. Pages 260-264. <https://doi.org/10.1016/j.oufs.2019.02.005>

Keremci CK, Albooz SS. The Limitation of Applying Heat to the External Lid Surface: A Case of Recalcitrant Meibomian Gland Dysfunction. *Case Reports in Ophthalmology*. 2017 Jun-Apr;8(1):7-12. doi:10.1159/000455087

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EYELID HYGIENE PROCEDURES (HOME-BASED)

- The role of eyelid hygiene is to effectively remove inflammatory debris and enhance expression of meibum through massage and warming
- Previous studies have determined that eyelid hygiene has a significant effect on meibomian gland dysfunction by comparative analyses between baseline and follow-up periods, or between treatments
- In a recent study, the maximum efficacy of eyelid hygiene was continuously increased up to 6 months and maintained for 4 months after stopping eyelid hygiene procedures (washing the eyelid margin with commercial eyelid scrub products after warm compression for 5-10 minutes)
- Only 40% of patients with meibomian gland dysfunction were compliant, even though face-to-face education regarding eyelid hygiene was provided at every visit during the study



Ahn H, Kim BY, Kim J, YW, Jun I, Kim TI, Lee HK, Seo KY. How Long to Continue Eyelid Hygiene in Treat Meibomian Gland Dysfunction? *J Clin Med*. 2022 Jun 20; 11(13):528. doi: 10.3390/jcm11030528 PMID: 3515982 PMCID: PMC887031

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EYELID HYGIENE PROCEDURES (IN-OFFICE)



Mibo Thermoflo

- A thermoelectric device that uses a silver paddle on a hand piece to deliver heat

iLux

- A device that applies light-based heat and compression while allowing for direct visualization of the glands

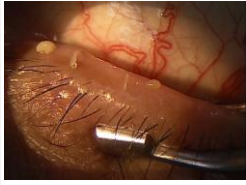
LipiFlow

- Automated thermal pulsation device for evacuation of the meibomian glands using intermittent heat and pressure

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EYELID HYGIENE PROCEDURES (IN-OFFICE)

- Successful treatment of obstructive meibomian gland dysfunction requires the elimination of glandular obstructions
- Thickened meibum produces a non-fixed obstruction which can usually be relieved by raising the temperature of the meibum and then compressing the glands to forcefully express the meibum
- Goal of gland expression is to restore intraductal integrity by re-establishing a patent duct/orifice outflow system
- Inability to express a gland after months of treatment or worsening symptoms after treatment suggests the presence of a fixed glandular obstruction like periductal fibrosis



Macklin SL, Alturi S. Expressible Meibomian Glands Have Occult Fibrotic Obstructions. *Cornea*. July 2019 - Volume 38 - Issue 7 - p 883-887. doi: 10.1097/ICO.0000000000001954

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EYELID STRUCTURAL EXAMINATION

Evaluate for proper eyelid-globe congruity – the eyelids should smoothly appose the globe

- Abnormal findings include ectropion, entropion, and pseudotrichiiasis

Evaluate for proper punctal apposition

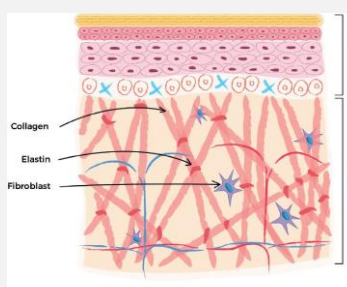
- The lower puncta should not be visible unless the eyelid is manually everted to expose them
- They should appose each other with eyelid closure

Evaluate the dynamics of eyelid closure

- Lower eyelid laxity is characterized by punctal eversion with eyelid closure, or one eyelid may override the other during the blink

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SKIN ANATOMY




- Within the dermis are collagen, elastic tissue, vasculature, nerve endings, hair follicles and glands
- Fibroblasts are the primary cell type in the dermis, and they contribute to the formation of connective tissue by secreting the collagen proteins that help maintain structural integrity
- Elastin fibers are an extracellular matrix protein responsible for the extensibility and elastic recoil of human tissue

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AGE-RELATED SKIN DAMAGE

- Appearance of wrinkles
- Appearance of fine lines
- Decrease in firmness
- Loss of density

Clinicopathologic studies indicate that a reduction of collagen and elastin fibers may contribute to the development of horizontal eyelid laxity in patients with involution ectropion and entropion of the lower eyelid



Damascono RW, Ozaki MH, Qaratai PE, Balfour R Jr. Involutional ectropion and entropion: clinicopathologic correlation between horizontal eyelid laxity and eyelid extracellular matrix. *Ophthalmol Plast Reconstr Surg*. 2011 Sep-Oct;27(5):321-6. doi: 10.1097/OPR.0b013e3182163764. PMID: 21490515.


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EYELID MALPOSITION

Although symptoms are important, a careful examination of the eyelids is required to determine any eyelid malposition and prescribe treatment

- Lower eyelid position
- Eyelid retraction test
- Eyelid laxity evaluation
- Lagophthalmos evaluation
- Floppy eyelid evaluation

Horizontal eyelid laxity is the primary cause of eyelid malposition and horizontal eyelid tightening can eliminate the laxity



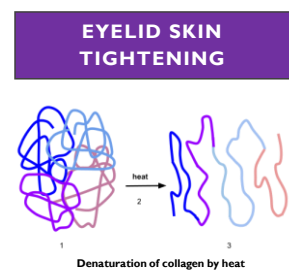
“Snap back test”

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EYELID SKIN TIGHTENING

Neocollagenesis and Skin Remodeling

- Goal of treatment is to “Get A Better Blink”
- Denaturation of collagen occurs when heat therapy destroys all the collagen heat-labile intramolecular crosslinks leading to an “unwinding” and change in structure from a highly-ordered crystalline form to a randomly distributed and gel-like shape
- The 3D structure of the biomolecule is changed and the function as a catalyst for biological reactions is lost
- The presence of denatured proteins implies a potential disruption in cell activity, usually damages the cell, and puts the cell at risk of early death
- Immune system responds to thermal injury and produces new and better collagen that results in tighter skin



1 Denaturation of collagen by heat 2 3

Avaro P,Albarino O, Mota F, Barrera Marina PAe Innovative temperature-controlling handpieces for face and body skin laxity and tightening treatment with radiofrequency skin. *Res Technol*. 2023 Jun;29(8):1385. doi: 10.1111/jrct.13385. PMID: 37357641; PMCID: PMC10246699.

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LOW-LEVEL LIGHT THERAPY



Park, Yul & Kim, Moon & Kim, Sehan & Cho, Kyong (2022). Effect of low-level light therapy in patients with dry eyes: a prospective, randomized, observational trial. *Scientific Reports*. 12, 18. 1038/41598-022-07427-6.



Costantini V, Le Fur M, Pelletier M, Granotier E. Reverse skin aging signs by red light photobiomodulation. *Skin Res Technol*. 2023 Jul;29(7):1239-1. doi: 10.1111/jrct.13391. PMID: 37522497; PMCID: PMC10311288.

Photobiomodulation is a process by which absorption of red or near infrared light energy produces a series of physiological effects at the cellular level

- First goal of light application is to modulate cellular bioenergetics to increase energy production
- Second goal is to reduce inflammation
- Additional functionalities include:
 - Thermal softening of meibum
 - Stimulates fibroblasts and thus increases production of collagen and elastin
 - Promotes the expression of genes associated with tissue regeneration and repair

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TISSUE PENETRATION

- Wavelength, power, intensity, light type, and the light delivery method may all influence penetration depth
- Pulsed wave photobiomodulation (PBM) is the delivery of light in a pulsed manner, where the light is turned on and off at specific intervals
- Continuous wave PBM is the delivery of light without any pulsation or interruption
- Recent studies demonstrate that pulsed wave PBM therapy does have biological and clinical effects that are different from those of continuous wave PBM therapy
- Pulsed wave PBM produces quench periods (pulse-off times) which reduces tissue heating, thereby allowing higher peak power densities for deeper tissue penetration

Kim HB, Bah KY, Chung PH, Chung SH. Pulse frequency dependency of photobiomodulation on the bioregulatory functions of human dermal pulp stem cells. *Sci Rep*. 2017 Nov 21;7(1):15937. doi: 10.1038/s41598-017-15754-3.PMID: 29143263.PMCID: PMC5619661.

Chouard V, Le Fur M, Pellerin M, Grosjean F. Reverse skin aging signs by red light photomodulation. *Skin Res Technol*. 2023 Jul;29(7):13391. doi: 10.1111/srt.13391.PMID: 37524957.PMCID: PMC10311288.

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INTENSE PULSED LIGHT

- Intense pulsed light (IPL) is created by a biostimulation device that uses a high-performance flash lamp to produce a non-coherent light output of large wavelength
- The basic principle of IPL therapy is selective photothermolysis
- IPL energy is directed to the skin and absorbed by chromophores such as melanin, hemoglobin and water, with the development of heat, thus inducing blood vessel coagulation and destruction

Talbotner B, Yazdani M, Ania R, Frazida F, Lohman TP. Intense pulsed light treatment in meibomian gland dysfunction: A concise review. *Dent Sur*. 2020 Oct;18(4):383-394. doi: 10.1016/j.dent.2020.06.002. Epub 2020 Jul 3. PMID: 32622639.

Thrombosis of disease-driven telangiectasia

Doppenberg M, Pagen & van Leeuwen, Ton & Vliet, Angela & Aulders, H. C. G. & Bakker, Erik. (2016). Submicrosecond thermal damage to cell types present in the skin. *International Journal of Hyperthermia*. 41. 10.1080/02643758.2016.2359493.

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INTENSE PULSED LIGHT

- Additional functionalities of intense pulsed light include
 - Thermal softening of meibum
 - Modulates the secretion of pro- and anti-inflammatory molecules
 - Decreases tissue inflammation by suppression of matrix metalloproteinases
 - Photobiomodulation to induce intracellular changes at the gene and protein levels
 - Activates fibroblasts and enhances collagen synthesis for skin tightening and rejuvenation
 - Increases adenosine triphosphate production
 - Reduces oxidative stress

Sawal, Abhishek & Hsu, J-sung & Zhou, Dan-dan & Liu, Xiu-En & Lu, Cheng-wei. (2020). Use of Intense Pulsed Light to Manage Meibomian Gland Dysfunction for Dry Eye Disease. *International Journal of Medical Sciences*. 17. 1385-1392. 10.7554/ijms.4288.

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RADIOFREQUENCY THERMAL THERAPY

Radiofrequency thermal therapy is a non-invasive, in-office procedure that is designed to deliver heat therapy to the skin and its associated structures

Heating the inner layer of the skin increases the temperature of the oil inside the meibomian glands, a recommended therapy in treating meibomian gland dysfunction

The aesthetic effects of radiofrequency therapy are based on a mild heating of the skin's underlying network of collagen and elastin fibers to stimulate new collagen and elastin production

Photo courtesy of Ki Hargis, O.D.

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COMBINATION LIGHT THERAPY

INTENSE PULSED LIGHT

LOW-LEVEL LIGHT THERAPY

All previous studies evaluating low-level light therapy in combination with intense pulsed light reported a significant improvement in ocular comfort after treatment

Gianfrancesco G, Pellegrini M, Carrozzini S, G. Bonelli M, Carrozzini D, Scorsini V. Low-Level Light Therapy Versus Intense Pulsed Light for the Treatment of Meibomian Gland Dysfunction: Preliminary Results From a Prospective Randomized Comparative Study. *Cornea*. 2023 Feb 1;42(2):141-144. doi: 10.1097/ICO.0000000000000997. Epub 2022 Feb 2. PMID: 36582033.

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CONCLUSIONS FROM IPL+LLLT STUDIES

"Combining IPL and LLLT treatments produced significant improvements in tear break-up time and MGD grading scores, with an associated improvement in the patient's OSDI score, one to three months after treatment"

Stonemacher K, Abell TG, Chottner B, Chostner E, Pevsiv R. Combined low level light therapy and intense pulsed light therapy for the treatment of meibomian gland dysfunction. *Clin Ophthalmol*. 2019 Jun 11;13:993-999. doi: 10.2147/OPTH.S213664.PMID: 31354233.PMCID: PMC6573774.

"This study confirmed the efficacy and safety of combined IPL and LLLT demonstrating its superiority compared to topical treatment"

Meduri A, Oliverio GW, Tedesco G, Aragona P. Combined intense pulsed light and low-level light therapy for the treatment of refractory Meibomian gland dysfunction. *European Journal of Ophthalmology*. 2023;33(2):728-734. doi: 10.1177/11206721211027026.

"Adding LLLT to IPL seems to have an additional benefit over time"

Castro C, Marques A, et al. (July 05, 2023). Comparison of Light-Based Devices in the treatment of Meibomian Gland Dysfunction. *Cornea*. 15(7):e41386. doi: 10.7759/cureus.41386.

"Light therapy is safe, and its application is easy and quick, thus representing a promising treatment for a prevalent condition like dry eye disease"

Perez-Sigüero MA, Perez-Sigüero D, Rivero-Santana A, Bernal-Buaco M, Encinas-Pisa P. Combined Intense Pulsed Light and Low-Level Light Therapy for the Treatment of Dry Eye: A Retrospective Before-After Study with One-Year Follow-Up. *Clin Ophthalmol*. 2021 May 21;15(2):133-140. doi: 10.2147/OPTH.S207020.PMID: 34045848.PMCID: PMC8149274.

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COMBINATION ENERGY-BASED THERAPY

INTENSE PULSED LIGHT + RADIOFREQUENCY THERAPY

In patients with moderate-to-severe dry eye disease due to meibomian gland dysfunction, four treatments of IPL+RF followed by meibomian gland expression produced the following:

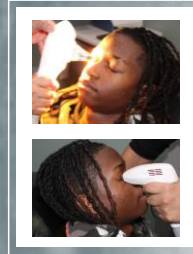
- Decreased symptoms of ocular discomfort
- Improved meibum quality
- Improved appearance of the eyelids
- Increased the number of expressible glands
- Decreased meibomian gland loss



Chelms J, Garcia CN, Hanra H. Multi-Frequency RF Combined with Intense Pulsed Light Improves Signs and Symptoms of Dry Eye Disease Due to Meibomian Gland Dysfunction. Clin Ophthalmol. 2023 Oct 26;17:3089-3102. doi: 10.2147/OPTH.S426544. PMID: 37881780; PMCID: PMC10395163.

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COMBINATION THERAPY FOR RECALCITRANT CHALAZION



Intense pulsed light + Radiofrequency + Eyelid debridement + Lotilaner 0.25% eyedrops

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OPEN - YOUR - MIND



- A multimodal treatment program is the best way to treat ocular and adnexal disease
- Reduce or eliminate meibomian gland obstruction with heat therapy and gland expression
- Reduce or eliminate ocular surface and eyelid inflammation with targeted pharmacologic therapy or energy-based therapies
- Treat tear film insufficiency with lubrication, medication, punctal occlusion and/or energy-based therapies applied to the eyelids
- Restore eyelid structure and function with intense pulsed light therapy, low-level light therapy and radiofrequency thermal therapy

"Be All The Optometrist You Can Be!"

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