

Advanced Clinical Dry Eye Treatment

CORY J. LAPPIN, OD, MS, FAAO
THE DRY EYE CENTER OF OHIO

© 2025 Dr. Cory J. Lappin



Disclosures

- ▶ Alcon
- ▶ Barti
- ▶ Bausch + Lomb
- ▶ Bruder Healthcare and M&S Technologies (Hilco Vision)
- ▶ CSI Dry Eye Software
- ▶ Dompé Pharmaceuticals
- ▶ Eyederm
- ▶ Eyenovia
- ▶ Harrow
- ▶ Lumenis
- ▶ Myze
- ▶ Nordic Pharma
- ▶ Norwood Device & Diagnostics
- ▶ NuLids
- ▶ Ocubio
- ▶ PRN Vision Group
- ▶ Rinsada
- ▶ SCOPE Health Inc
- ▶ Sight Sciences
- ▶ TearRestore
- ▶ Tarsus Pharmaceuticals
- ▶ Viatrix Pharma (Oyster Point Pharma)
- ▶ Vital Tears

The content of this COPE accredited course was prepared independently. I have received no financial or commercial support for this presentation. All relevant relationships have been mitigated.

© 2025 Dr. Cory J. Lappin



“Dry eye is a multifactorial, *symptomatic* disease characterized by a loss of homeostasis of the tear film and/or ocular surface, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities are etiological factors.”

**- TFOS DEWS III Diagnostic
Methodology Report**

Diagnostics

Diagnostics

- ▶ **Questionnaires**
 - ▶ Traditional
 - ▶ SPEED, OSDI, DEQ-5, SANDE
 - ▶ Software
 - ▶ CSI
- ▶ **Slit lamp**
- ▶ **Vital dyes**
 - ▶ Sodium fluorescein
 - ▶ Lissamine green
- ▶ **Anterior segment photography**
- ▶ **Tear meniscus height**
- ▶ **TBUT**
 - ▶ Traditional & Noninvasive
- ▶ **Korb-Blackie light test**
- ▶ **Meibography**
- ▶ **Lipid layer interferometry**
- ▶ **Blink analysis**
- ▶ **Osmolarity**
- ▶ **MMP-9 analysis**
- ▶ **Schirmer testing(?)**
- ▶ **Corneal sensitivity testing**
 - ▶ Cotton wisp, dental floss, tissue
 - ▶ Cochet-Bonnet aesthesiometer
 - ▶ Belmonte & Brill Engines esthesiometers
- ▶ **“Proparacaine Challenge”**
- ▶ **In-vivo corneal confocal microscopy**

© 2025 Dr. Cory J. Lappin



Questionnaires

Traditional:

- ▶ SPEED (Standard Patient Evaluation of Eye Dryness)
- ▶ OSDI (Ocular Surface Disease Index)
 - ▶ OSDI-6
- ▶ DEQ-5 (Dry Eye Questionnaire)
- ▶ SANDE (Symptom Assessment Questionnaire in Dry Eye)

Software:

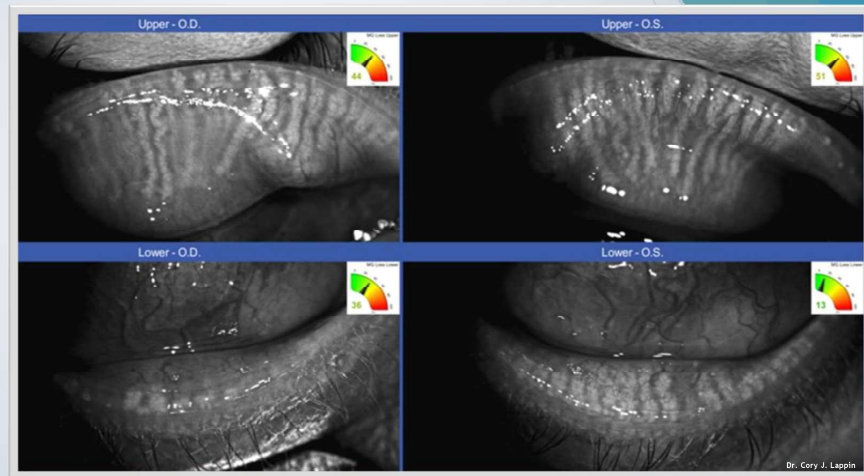
- ▶ CSI Dry Eye

© 2025 Dr. Cory J. Lappin



Meibography

- ▶ Assessment of meibomian gland structure
 - ▶ Transillumination
 - ▶ Infrared

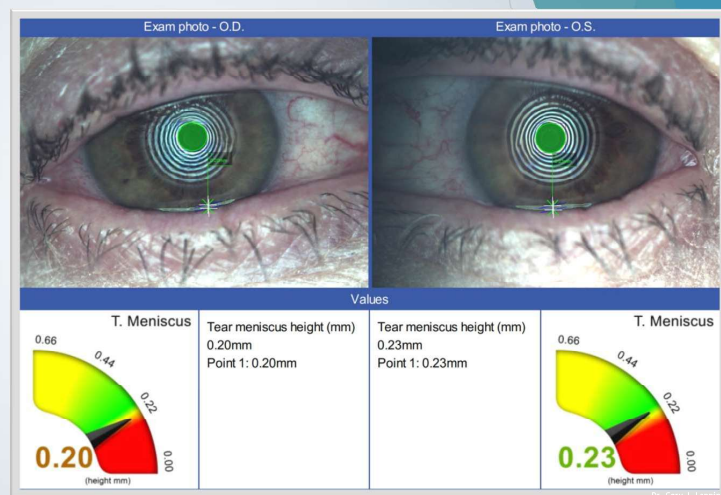


© 2025 Dr. Cory J. Lappin

THE DRY EYE CENTER
OF OHIO

Tear Meniscus Height

- ▶ Estimate of tear film volume
 - ▶ Holds 70-90% of total tear volume of ocular surface
 - ▶ ~0.20-0.50 mm is normal



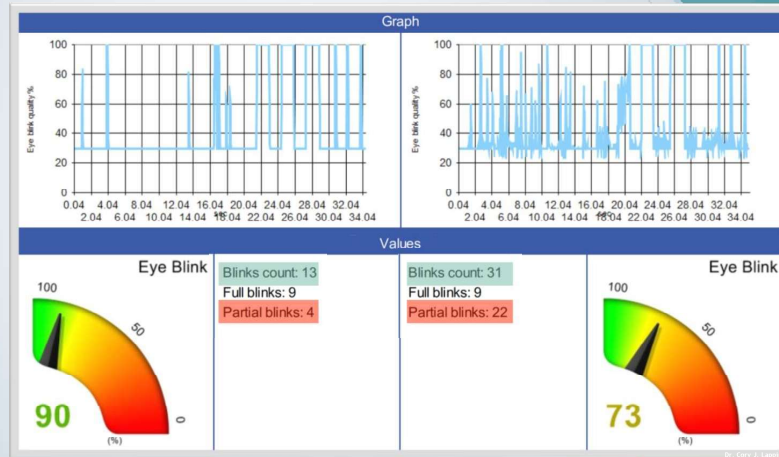
© 2025 Dr. Cory J. Lappin

THE DRY EYE CENTER
OF OHIO

Blink Analysis

Assessment of blink behavior

- ▶ Total number of blinks
- ▶ Full vs partial
- ▶ Normal average:
 - ▶ 15-20x per minute



© 2025 Dr. Cory J. Lappin

THE DRY EYE CENTER
OF OHIO

Lipid Layer Interferometry

Measurement of lipid layer thickness

- ▶ Estimate of meibum production
- ▶ Proxy for meibomian gland function
- ▶ ~80-100+ nm is considered normal

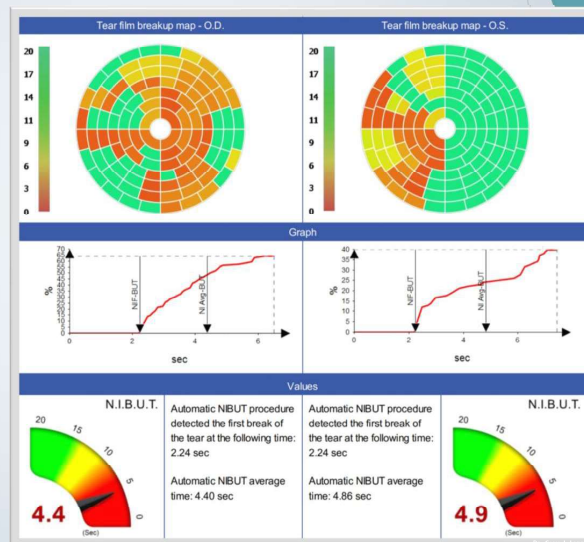


© 2025 Dr. Cory J. Lappin

THE DRY EYE CENTER
OF OHIO

Tear Breakup Time

- ▶ Estimate of tear film stability
 - ▶ Traditional
 - ▶ First TBUT
 - ▶ Noninvasive
 - ▶ First and average TBUT
 - ▶ 10 seconds considered normal

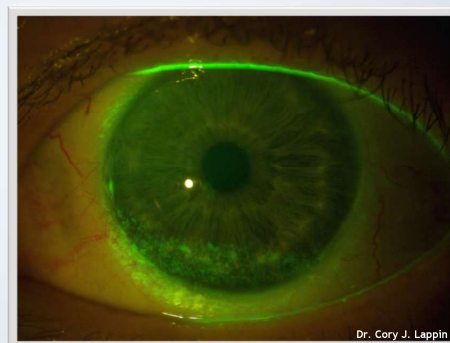


© 2025 Dr. Cory J. Lappin

THE DRY EYE CENTER
OF OHIO

Vital Dyes

- ▶ Fluorescein
 - ▶ Damaged and/or devitalized cells
 - ▶ Epithelial defects
- ▶ Lissamine green
 - ▶ Dead and devitalized cells



© 2025 Dr. Cory J. Lappin

THE DRY EYE CENTER
OF OHIO

Anterior Segment Photography

- ▶ **Many setup options:**
 - ▶ Dedicated/mounted
 - ▶ External/attachable
- ▶ **Documentation**
- ▶ **Education**



<https://www.dryeyejournal.com/products/photography-adapters/>

© 2025 Dr. Cory J. Lappin

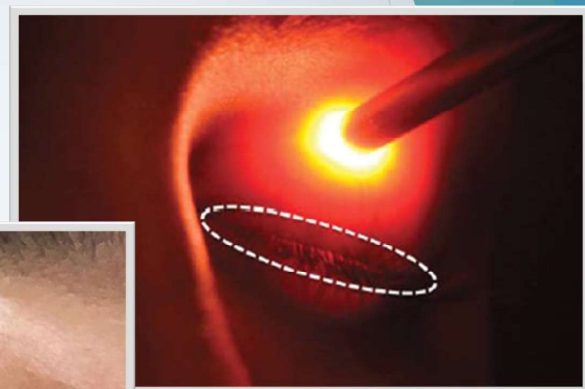


Korb-Blackie Light Test

- ▶ **Assessment of lid closure**
 - ▶ Lagophthalmos
 - ▶ Poor lid seal



Dr. Cory J. Lappin



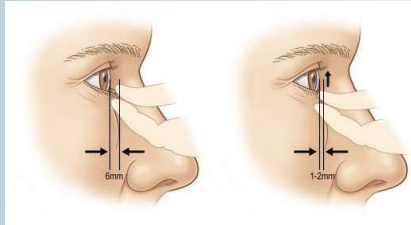
From: Blackie CA, Korb DR. A novel lid seal evaluation: the Korb-Blackie light test. Eye Contact Lens. 2015;41(2):98-100. doi:10.1097/ICL.0000000000000072

© 2025 Dr. Cory J. Lappin



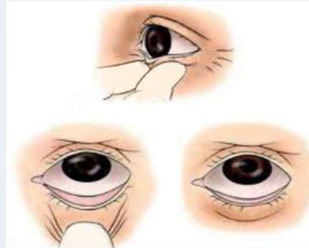
Eyelid Assessment

Lower Lid Distraction Test (LLDT)



- ▶ Pull the lower lid from the globe
 - ▶ Measure the distance
 - ▶ LLDT >6 mm is abnormal

Snap Back Test (SBT)



- ▶ Pull the lower lid away from the globe and release.
 - ▶ Measure time to snap back to original position
 - ▶ >1 sec is abnormal

Blinking Behavior Assessment



- ▶ Blink Rate
 - ▶ Number of blinks per minute
- ▶ Blink Quality
 - ▶ Full vs partial closure of eyelids

© 2025 Dr. Cory J. Lappin



Eyelid Assessment

Normal Eyelid Position

- ▶ Upper Lid
 - ▶ 1.0-2.0 mm below superior limbus
- ▶ Lower Lid
 - ▶ At or slightly above inferior limbus



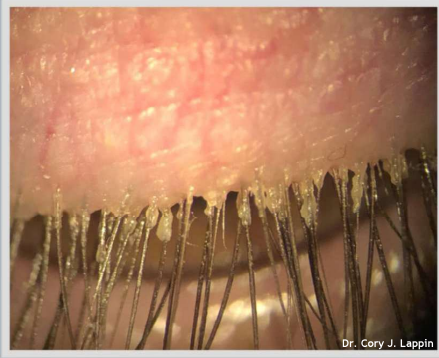
Dr. Cory Lappin

© 2025 Dr. Cory J. Lappin



Lid Margin and Lash Assessment

Have patient look down



Observe lid margin

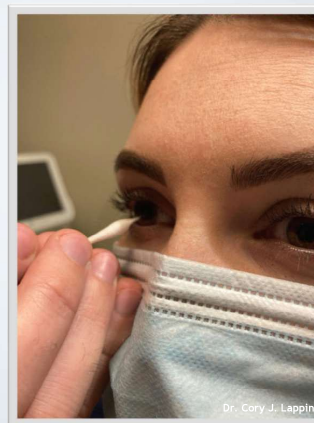


© 2025 Dr. Cory J. Lappin



Corneal Sensitivity Testing

- ▶ Cotton wisp, dental floss, tissue
- ▶ Warmed saline, hyperosmolar eye drops, capsaicin
- ▶ Cochet-Bonnet aesthesiometer
- ▶ Belmonte noncontact gas esthesiometer
- ▶ Brill Engines corneal esthesiometer



© 2025 Dr. Cory J. Lappin



“Proparacaine Challenge”

- ▶ **Assessment of neuropathic pain**
 - ▶ Central vs Peripheral

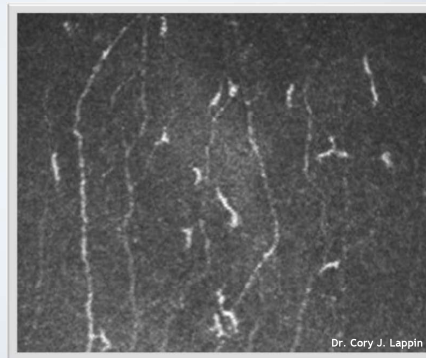


© 2025 Dr. Cory J. Lappin



In-vivo Corneal Confocal Microscopy

- ▶ **Assessment of corneal nerve structure**
 - ▶ Density
 - ▶ Beading
 - ▶ Dendritic cells



© 2025 Dr. Cory J. Lappin



Osmolarity

- ▶ **Analysis of tear film solute content**

- ▶ Evaporation
- ▶ Tear production



Inflammation

- ▶ **MMP-9**

- ▶ Inflammatory marker elevated in tear film in dry eye



Dietary Supplements

- ▶ **Omega-3 fatty acids**
 - ▶ High quality, re-esterified, triglyceride-based supplement
 - ▶ 3:1 EPA to DHA ratio
 - ▶ 2 grams of combined EPA + DHA
- ▶ **Vitamin D**
- ▶ **Lutein & zeaxanthin**
- ▶ **Curcuminoids**
 - ▶ Turmeric



© 2025 Dr. Cory J. Lappin



Compresses

- ▶ **Warm vs Cold**
- ▶ **Traditional vs Advanced**

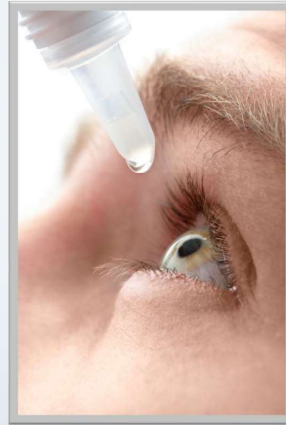


© 2025 Dr. Cory J. Lappin



Artificial Tears

- ▶ Preservative free
- ▶ Tears, gel, ointment
- ▶ Lipid-based
- ▶ High molecular weight hyaluronic acid
- ▶ Carbomer



© 2025 Dr. Cory J. Lappin

THE DRY EYE CENTER
OF OHIO

Hygiene

- ▶ Hypochlorous acid
- ▶ Tea tree oil
- ▶ Okra-based cleansers
- ▶ Wipes, foams, sprays
- ▶ **NO BABY SHAMPOO**



Tea Tree. A brand of Avon Skin-Soothe & Shimmer. Information courtesy of Avon, Inc. 18 FL OZ (532 mL). 100% (100%) Avon Skin-Soothe & Shimmer. Published January 6, 2025.

© 2025 Dr. Cory J. Lappin

THE DRY EYE CENTER
OF OHIO

Prescription Treatments

© 2025 Dr. Cory J. Lappin



Anti-inflammatories

- ▶ **Corticosteroids**
 - ▶ Eysuvis
- ▶ **Corticotropin gel (ACTH)**
 - ▶ Steroidal and non-steroidal pathway
 - ▶ Melanocortin system
 - ▶ Cortrophin, Acthar



© 2025 Dr. Cory J. Lappin



Immunomodulators

▶ Cyclosporine

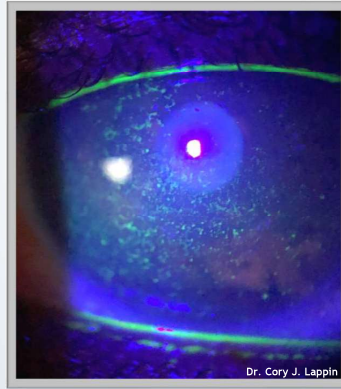
- ▶ Cequa, Vevye, Restasis
 - ▶ Suppresses T cell response via calcineurin inhibition

▶ Lifitegrast

- ▶ Xiidra
 - ▶ Suppresses T cell response via blocking binding of LFA-1 and ICAM-1

▶ Tacrolimus

- ▶ Suppresses T cell response via calcineurin inhibition



© 2025 Dr. Cory J. Lappin

THE DRY EYE CENTER
OF OHIO

MMP-9 Inhibitors

▶ Doxycycline

- ▶ Generic
- ▶ Oracea
 - ▶ 40 mg tablet
 - ▶ 30 mg immediate + 10 mg extended

▶ Azithromycin

- ▶ Oral
- ▶ Topical
 - ▶ AzaSite



Doxylin 401 Doxycycline (doxycycline) Tablets (page 4) CC-BY 2.0, www.doxycycline.co.uk, Published September 3, 2019. Accessed December 15, 2021.

© 2025 Dr. Cory J. Lappin

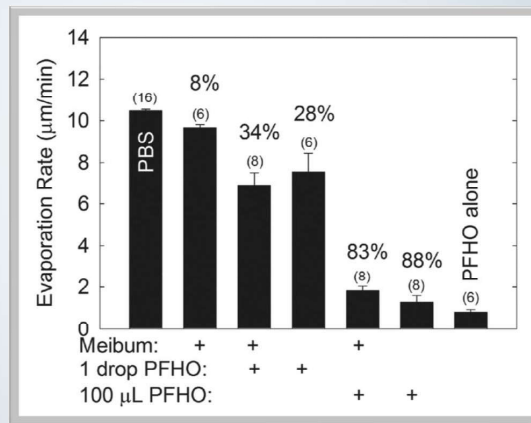
THE DRY EYE CENTER
OF OHIO

Tear Film Stabilizers

► Perfluorohexyloctane

► Miebo

- Reduces tear film evaporation



From Vittitow J, Kissling R, DeCory H, Borchman D. In Vitro Inhibition of Evaporation with Perfluorohexyloctane, an Eye Drop for Dry Eye Disease. Curr Ther Res Clin Exp. 2023;98:100704. Published 2023 May 12. doi:10.1016/j.curtheres.2023.100704

Neuromodulators

► Increases tear production

► Topical

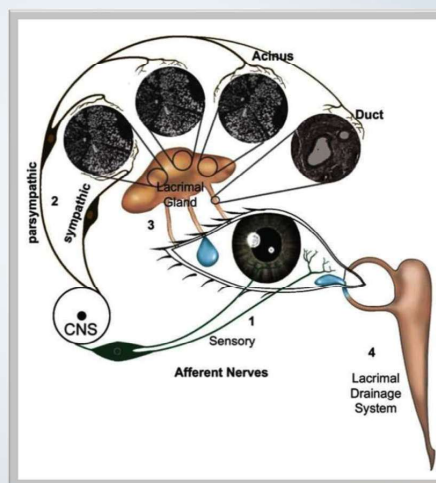
- Acoltremon
- Tryptyr

► Nasal

- Varenicline
- Tyrvaya

► External

- iTear100
- External



From Dartt DA. Neural regulation of lacrimal gland secretory processes: relevance in dry eye diseases. Prog Retin Eye Res. 2009;28(3):155-177.

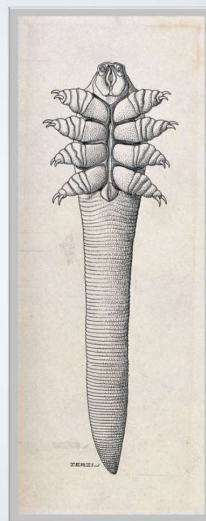
Biologics

- ▶ Autologous serum tears
- ▶ Platelet-rich plasma (PRP)
 - ▶ Greater concentration of growth factors
- ▶ Amniotic membranes
 - ▶ Cryopreserved, lyophilized, dehydrated
- ▶ Recombinant human nerve growth factor
 - ▶ Cenegermin-bkbj
 - ▶ Oxervate



Antiparasitics

- ▶ Lotilaner
 - ▶ Xdemvy
- ▶ Ivermectin
 - ▶ Risk of neurological toxicity
- ▶ Metronidazole
 - ▶ Exact mechanism unknown



Artificial Barrier Environments

© 2025 Dr. Cory J. Lappin



Therapeutic Contact Lenses

- ▶ Soft bandage lenses
- ▶ Scleral lenses



Copyright: Dry eyes scleral lens as reverse of pharynx. Wikimedia Commons. CC-BY-SA 3.0. <https://commons.wikimedia.org/wiki/File:PharynxMED4049>. Published May 18, 2014. Accessed September 9, 2021.

© 2025 Dr. Cory J. Lappin



Protective Barriers

- ▶ Sleep goggles
- ▶ Lid tape/patches
- ▶ Moisture chamber spectacles



© 2025 Dr. Cory J. Lappin



Other Treatments

© 2025 Dr. Cory J. Lappin



Allergies and Hypersensitivities

▶ Antihistamine-Mast Cell Stabilizer Combos

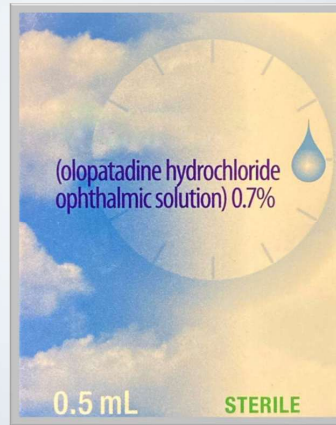
- ▶ Olopatadine
 - ▶ Pataday
- ▶ Alcaftadine
 - ▶ Lastacast

▶ Anti-inflammatories

- ▶ Steroids (topical and oral)

▶ Immunomodulators

- ▶ Cyclosporine
 - ▶ Verkazia
- ▶ Tacrolimus



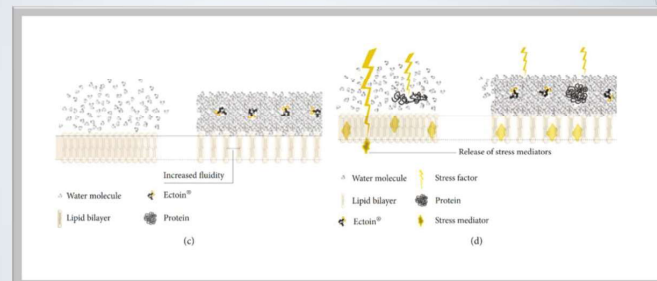
© 2025 Dr. Cory J. Lappin



Allergies and Hypersensitivities

▶ Preferential Exclusion

- ▶ “Water shield”
- ▶ Ectoin
 - ▶ Allegro



From Bilstein A, Heinrich A, Rybachuk A, Mösges R. Ectoin in the Treatment of Irritations and Inflammations of the Eye Surface. Biomed Res Int. 2021;2021:8885032. Published 2021 Feb 9. doi:10.1155/2021/8885032

© 2025 Dr. Cory J. Lappin



Cosmetics

▶ Vasoconstrictors

- ▶ Brimonidine tartrate
 - ▶ Lumify
- ▶ Avoid
 - ▶ Tetrahydrozoline
 - ▶ Visine
 - ▶ Naphazoline
 - ▶ ClearEyes
 - ▶ Rebound redness

▶ Lid elevator

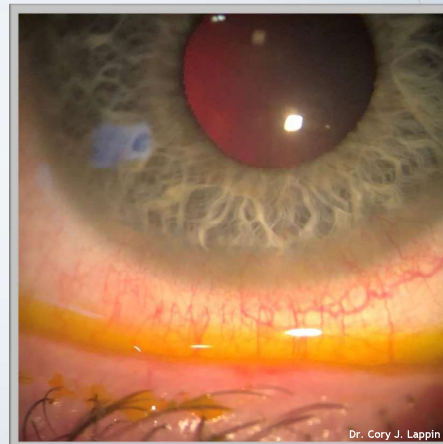
- ▶ Oxymetazoline
 - ▶ Upneeq
 - ▶ Ptosis

▶ PGA-free lash serums



Punctal Plugs

- ▶ Cost vs Benefit
- ▶ Controversial
 - ▶ Based on antiquated understanding of DED
- ▶ “Cesspool” Effect
 - ▶ Potential to exacerbate inflammation
- ▶ Lacrimal occlusion - A better option?
 - ▶ Canalicular gel (Lacrifill)
 - ▶ Cross-linked hyaluronic acid
 - ▶ Lasts up to six months
 - ▶ No sizing required
 - ▶ No risk of mechanical irritation
 - ▶ Can be reversed with irrigation



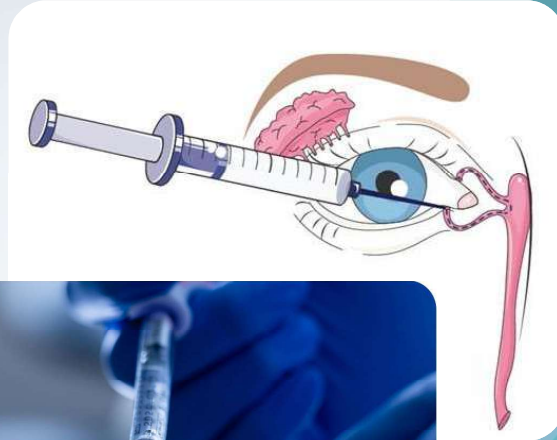
Dr. Cory J. Lappin

Punctal Plugs

- ▶ **Lacrimal occlusion - A better option?**

- ▶ **Canalicular gel (Lacrifill)**

- ▶ Cross-linked hyaluronic acid
 - ▶ Lasts up to six months
 - ▶ No sizing required
 - ▶ No risk of mechanical irritation
 - ▶ Can be reversed with irrigation



© 2025 Dr. Cory J. Lappin



In-office Procedures

© 2025 Dr. Cory J. Lappin



Microblepharoexfoliation

- ▶ NuLids PRO
- ▶ ZEST
- ▶ BlephEx



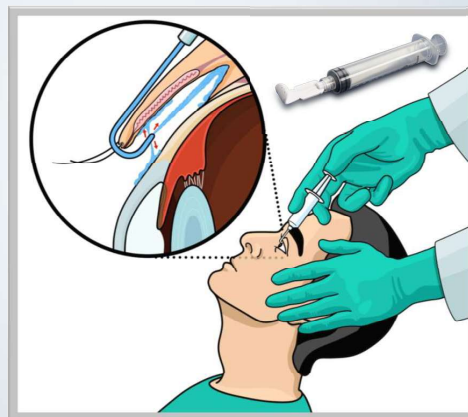
<https://www.nulids.com/lappin/nulids-pro>

© 2025 Dr. Cory J. Lappin



Ocular Surface Lavage

- ▶ Rinsada
 - ▶ High-pressure saline irrigation



<https://www.rinsada.com/>

© 2025 Dr. Cory J. Lappin



Thermal Treatments

- ▶ LipiFlow
- ▶ iLux
- ▶ TearCare



© 2025 Dr. Cory J. Lappin

THE
DRY EYE CENTER
OF OHIO

Intense Pulsed Light (IPL)

- ▶ MGD
 - ▶ Improves meibomian gland structure, function, quality of meibum, and tear breakup time
- ▶ Inflammation
 - ▶ Reduces inflammatory factors found in tear film and ocular surface
- ▶ Ocular rosacea
 - ▶ Destroys proinflammatory telangiectatic blood vessels
- ▶ Blepharitis
 - ▶ Decreases Demodex and bacterial populations on lids and lashes



© 2025 Dr. Cory J. Lappin

THE
DRY EYE CENTER
OF OHIO

Low-Level Light Therapy (LLLT)

- ▶ **Photobiomodulation**
 - ▶ Reduces inflammation
 - ▶ Stimulates cellular function
 - ▶ Promotes healing



© 2025 Dr. Cory J. Lappin



Radiofrequency (RF)

- ▶ **Targeted heat delivery**
 - ▶ Frequency specific
 - ▶ Liquefies meibum
- ▶ **Improves skin quality**
 - ▶ Stimulates collagen synthesis
 - ▶ Potentially improves blink mechanics



© 2025 Dr. Cory J. Lappin



Dynamic Muscle Stimulation (DMSt)

- ▶ **Targets and stimulates contraction of facial muscles**
 - ▶ Orbicularis oculi
 - ▶ Muscle of Riolan
- ▶ **Improves**
 - ▶ Lid tone
 - ▶ Blink quality
 - ▶ Meibum secretion



© 2025 Dr. Cory J. Lappin



Pipeline

- ▶ **Reproxalap ophthalmic solution 0.25%**
 - ▶ Reactive aldehyde species (RAS) inhibitor
 - ▶ Inhibits inflammation quickly
- ▶ **AZR-MD-001 selenium sulfide ophthalmic ointment 0.5%**
 - ▶ Cytostatic agent with keratolytic and keratostatic properties
 - ▶ Increases lipogenesis and breaks disulfide bonds
- ▶ **Urcosimod (OK-101) ophthalmic solution**
 - ▶ Lipid conjugated chemerin peptide ChemR23 G-protein coupled receptor agonist
 - ▶ Found on immune cells
- ▶ **EyeCool Device for Chronic Ocular Surface Pain**
 - ▶ In-office procedure that uses cooling to target nerves and reduce pain

© 2025 Dr. Cory J. Lappin



Pipeline

▶ CSB-001

- ▶ Human recombinant dHGF, 5-amino acid deleted hepatocyte growth factor
- ▶ Enhances corneal wound healing through antifibrotic, anti-inflammatory, and neurotrophic properties

▶ PL9643 ophthalmic solution 1 µg/mL

- ▶ Synthetic melanocortin receptor (MCR) pan-agonist

▶ OC-101 AAV-NGF

- ▶ Intra-lacrimal gland injection-based gene therapy to increase NGF production

▶ OTX-CSI

- ▶ Preservative-free cyclosporine intracanalicular hydrogel insert

▶ Lacripeg ophthalmic solution

- ▶ Promotes tear secretion

▶ ALY688 ophthalmic solution

- ▶ Small peptide analogue of adiponectin that promotes epithelial wound healing

▶ INV-102 ophthalmic solution

- ▶ Regulates activity of p53, a protein involved in DNA damage repair

Thank you!

Instagram: @cory.lappin