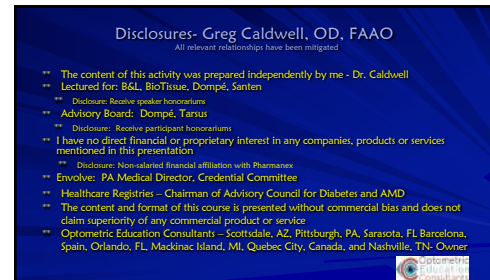
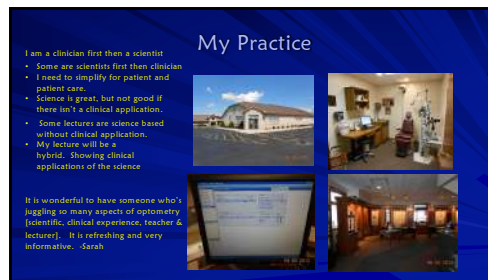


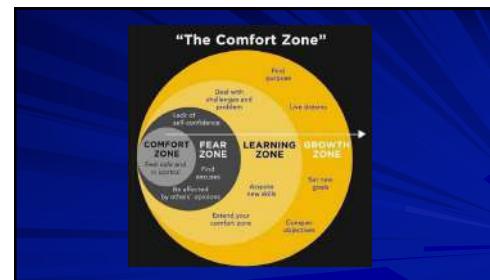
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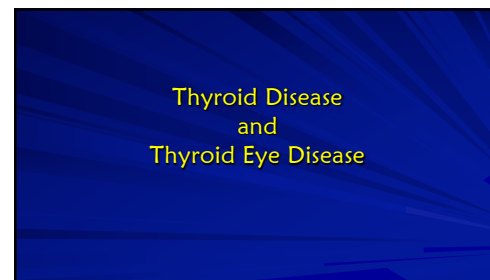
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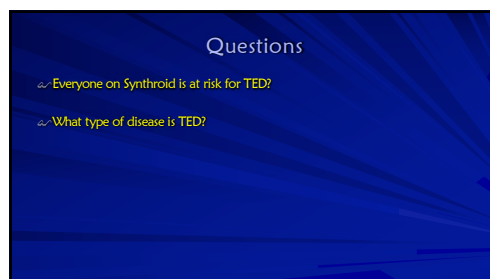
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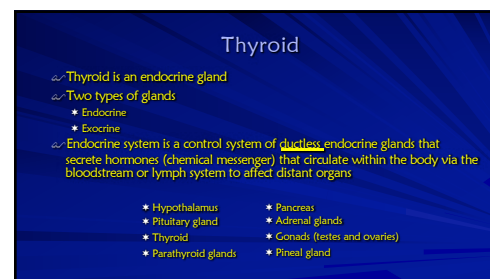
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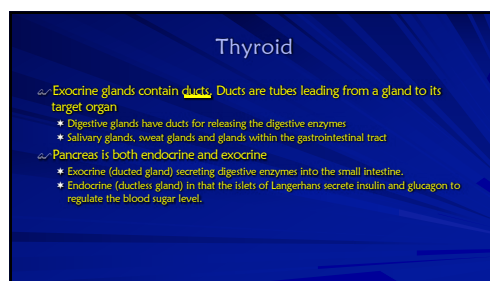
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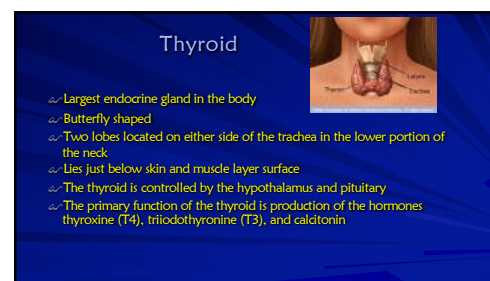
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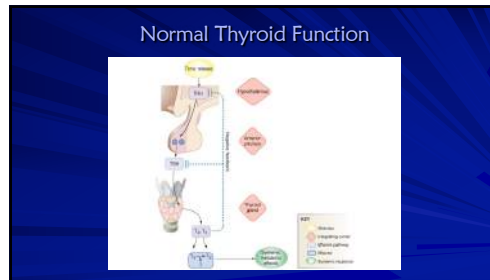
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14



15

Thyroid Dysfunction

What is the most common cause of thyroid dysfunction?

- Cancer
- Surgically induced
- Medication toxicity or side effect
- Pregnancy
- Autoimmune disease

In autoimmune disease the body typically produces \_\_\_\_\_ that attacks itself, this can be systemic or organ specific

- Antibodies, immunoglobulins

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Why Autoimmune Disease is on the Rise?

17

Why Autoimmune Disease is on the Rise?

"Hundreds of autoimmune cases began to show up at the age of 10 and 11," says the author. "However, we are now seeing some strange symptoms that never had such close before."

The example, the biggest recent increase in autoimmune disease cases has been in the United States and not Asia. Before that they had mostly seen the disease."

"These findings lack certain important ingredients, such as diet, and evidence suggests the alteration affects a person's microbiome - the collection of trillions of organisms that we have in our gut and which play a very role in controlling whether healthy function," Tronzo said.

"These changes in our autoimmune system are triggering autoimmune diseases, of which there are about 100 types, have never been discovered."

Early scientists assumed that individual susceptibility was involved in contracting such diseases, whereas that also included other diseases as well as factors, which trigger autoimmune and swelling, and can cause damage to various organs, including the heart.

18

Thyroid Dysfunction

Primary=Thyroid gland

Secondary= Pituitary failure

Tertiary= Hypothalamic

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### Antibodies of Thyroid Dysfunction

- **TSH Receptor Antibodies**
  - Stimulating TSH receptor antibody
    - Thyroid Stimulating Immunoglobulin (TSI)
  - Thyroid blocking antibody (TBAb)
- **Thyroid Peroxidase Antibodies (TPOAb)**
  - TPO is found in thyroid follicle cells where it converts the thyroid hormone T4 to T3
  - TPOAb contributes to thyroid cellular destruction
- Most autoimmune thyroid dysfunctions have a combination of thyroid antibodies, however depending on which AB is more abundant results in the outcome of the disease

20

Ninja Nerd Science  
YouTube

21

Autoimmune thyroid disease: new models of thyroid dysfunction

22

23

Complement factor H in AMD: Rifting genetic associations and pathobiology

Thyroid Function Tests

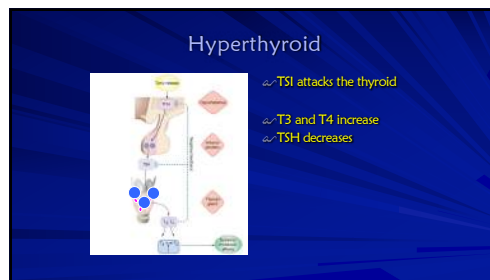
Test	Normal Range	Abnormal Range
TSH	0.4 - 4.0 mIU/L	< 0.4 (Hyperthyroidism) / > 4.0 (Hypothyroidism)
Free T4	0.8 - 1.8 ng/dL	< 0.8 (Hypothyroidism) / > 1.8 (Hyperthyroidism)
Free T3	2.3 - 4.2 pg/dL	< 2.3 (Hypothyroidism) / > 4.2 (Hyperthyroidism)

24

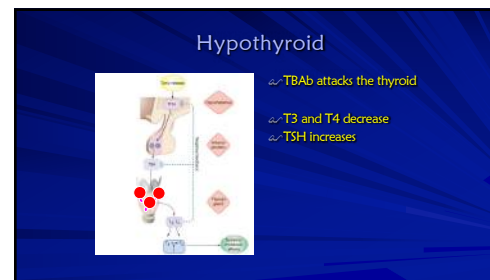
April 27, 2021 – January 26, 2022 (9 months)

Melanie Clemmons, OD  
May 20, 2022 AACO Nashville

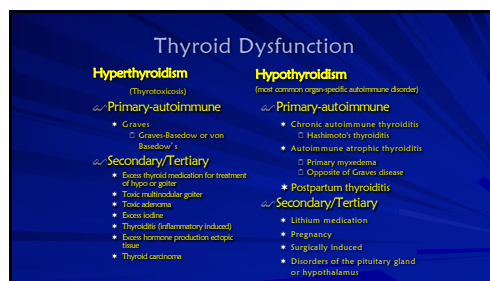
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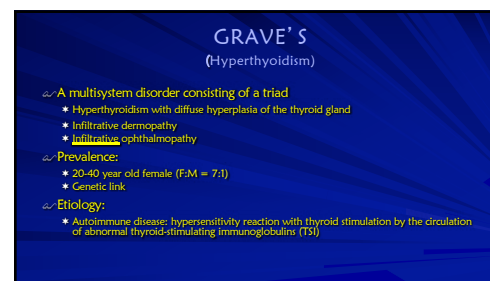
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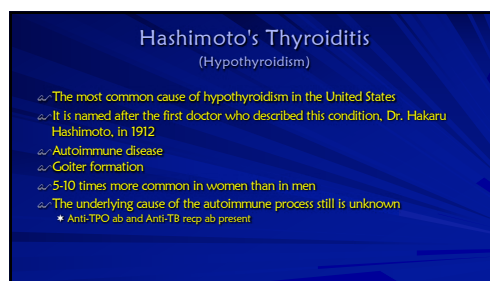
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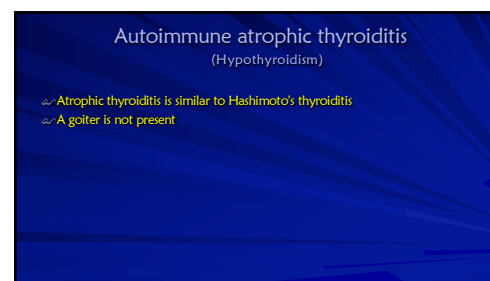
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31



### Postpartum Thyroiditis (Hypothyroidism)

These women develop antibodies to their own thyroid during pregnancy, causing an inflammation of the thyroid after delivery

32

### Systemic Manifestations of Hyperthyroid (Primary or Secondary)

<p><b>Symptoms</b></p> <ul style="list-style-type: none"> <li>Nervousness</li> <li>Heat intolerance</li> <li>Sweating</li> <li>Fatigue</li> <li>Palpitation</li> <li>Insomnia</li> <li>Early waking</li> <li>Alopecia</li> <li>Vitiligo</li> <li>Brittle nails</li> </ul>	<p><b>Signs</b></p> <ul style="list-style-type: none"> <li>Sweating</li> <li>Muscle Weakness</li> <li>Emotionally labile</li> <li>Tremor</li> <li>Tachycardia</li> <li>Arrhythmia</li> <li>Hypertension</li> <li>Brisk tendon reflex</li> <li>Diabetes</li> <li>(Tangier's &amp; Ca<sub>2+</sub>) CHO</li> <li>Microcytic anemia</li> <li>Possible goiter</li> <li>Myxedema</li> </ul>
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### Systemic Manifestations of Hypothyroid (Primary or Secondary)

<p><b>Symptoms</b></p> <ul style="list-style-type: none"> <li>Cold intolerance</li> <li>Weakness</li> <li>Reduced energy</li> <li>Lethargy</li> <li>Muscle cramps</li> <li>Constipation</li> <li>Increased sleeping</li> <li>Weight gain</li> <li>Reduced appetite</li> <li>Joint stiffness</li> </ul>	<p><b>Signs</b></p> <ul style="list-style-type: none"> <li>Cool, scaling skin</li> <li>Puffy hands and face</li> <li>Deep voice</li> <li>Myotonia</li> <li>Delirium</li> <li>Bradycardia</li> <li>Slow reflexes</li> <li>Obesity</li> <li>Hypothermia</li> <li>Myxedema</li> </ul>
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### Thyroid Eye Disease (TED)

**Other names used**

- Grave's disease
- Grave's ophthalmopathy
- Grave's orbitopathy
- Exophthalmos in Graves Disease
- Thyroid Associated Orbitopathy (TAO)
- Thyroid Orbitopathy
- Ophthalmic Graves Disease
- Inflammatory Eye Disease
- Endocrine Orbitopathy

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### Why is this so confusing?

**Thyroid Eye Disease**

- Is often seen in conjunction with Graves' Disease (hyperthyroid)
- Is seen in people with no other evidence of thyroid dysfunction
- Is seen in patients who have Hashimoto's Disease (hypothyroid)

Most thyroid patients, however, will not develop thyroid eye disease

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### Why is this so confusing?

- The eye symptoms usually occur at the same time as the thyroid disease
  - However they may precede or follow the obvious symptoms of the thyroid abnormality
- The incidence of thyroid eye disease associated with thyroid dysfunction is higher and more severe in smokers
  - There is no way to predict which thyroid patients will be affected

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### Why is this so confusing?

- While eye disease may be brought on by thyroid dysfunction
  - Successful treatment of the thyroid gland does not guarantee that the eye disease will improve
  - No particular thyroid treatment can guarantee that the eyes will not continue to deteriorate
  - Once inflamed, the eye disease may remain active from several months to as long as three years
  - There may be a gradual or, in some cases, a complete improvement

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### Thyroid Eye Disease

- Commonly known as Graves' ophthalmopathy
- About 80% of all patients with TED have the autoimmune hyperthyroid disorder known as Graves' disease
- Another 10% of all cases are seen in patients with autoimmune hypothyroidism, either Hashimoto's thyroiditis, atrophic thyroiditis or Hashimoto's
- Another 10% of all cases are seen in people with normal thyroid function
  - When thyroid function is normal, the eye condition is referred to as euthyroid Graves' disease
  - Euthyroid is a term meaning that thyroid function tests are normal. Most people with euthyroid Graves' disease develop a thyroid disorder within eighteen months of the emergence of the eye disorder
  - But some people with euthyroid Graves' disease never develop thyroid dysfunction

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### Thyroid Eye Disease

- What causes the Thyroid Eye Disease signs and symptoms?
- The high and low levels of T3 and T4
- The antibodies that are attacking the thyroid gland

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### Thyroid Eye Disease

- Thyroid Eye Disease has 2 phases
  - A phase secondary to abnormal thyroid hormone levels
    - Increased or decreased FT3 and FT4 levels
    - Once these levels are normalized, ocular symptoms will resolve
  - Congestive Autoimmune form of Thyroid Eye Disease
    - Active phase-stimulating or blocking TRAb are causing ocular activity
    - Plateau phase-reduced activity
    - Resolution phase-symptoms regress and eyes return to normal

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### Phase secondary to abnormal thyroid hormone levels (T<sub>3</sub>/T<sub>4</sub>) (Thyroid Eye Disease)

<ul style="list-style-type: none"> <li>Hyperthyroidism eye symptoms                             <ul style="list-style-type: none"> <li>Excess hormone acting on the nerves that supply the eye</li> <li>Usually spastic and include staring</li> <li>Dryness</li> <li>Eyelid retraction</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Hypothyroidism eye symptoms                             <ul style="list-style-type: none"> <li>Deficient hormone causing venous congestion, impaired circulation and fluid stagnation</li> <li>Periorbital edema</li> </ul> </li> </ul>
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- This form of TED resolves within a few weeks after thyroid hormone levels (FT4 and FT3) are corrected and brought back into the normal range
- The pituitary hormone TSH can stay low or suppressed for many months during the course of treatment for hyperthyroidism and doesn't mean that the patient is still hyperthyroid
- TSH also lags at least 6 weeks behind thyroid hormone levels and often remains elevated longer in people who have been hypothyroid
- Keeping on the TSH level can be misleading and in treating TED

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### Congestive Autoimmune form of Thyroid Eye Disease (Active phase, Plateau phase, Resolution phase)

- Caused by both stimulating and blocking TSH receptor antibodies (TRAb) and also immune system chemicals known as cytokines
- Secondary targets appear to be TSH receptor antigens (epitopes) located on orbital fibroblasts as well as dermal fibroblasts
- Active "inflammatory" phase of TED varies
  - Symptoms resolve quickly although on average the active phase lasts about 12-18 months
  - TRAb levels are high, patients are smokers, nutrient deficiencies are present, or the patient continues to be exposed to environmental triggers such as excess dietary iodine, the active phase can last as long as 3 years
  - Avoid any iodine, muscle or orbital surgery
- Plateau phase and Resolution "Passive" phase
  - An individual may be left with structural changes, such as eye protrusion, eyelid retraction, and in some cases, double vision
  - There are corrective procedures that can be performed to address these problems

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### Euthyroid Graves' disease

~ If thyroid function is normal.  
How does one develop thyroid eye disease?

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Similar receptors are found in the skin, fat and muscle of the orbit

45

You're in the Know

Normal Values  
Thyroglobulin 20 IU/ml  
Peroxidase <35 IU/ml  
TSH 1.75 IU/ml

It does work!

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### General Ocular Symptoms

- ~ Prominent eyes, stare
- ~ Pain
- ~ Lacrimation
- ~ Eyelid swelling
- ~ Foreign-body sensation
- ~ Double vision
- ~ Photophobia
- ~ Decreased vision in one or both eyes

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### NOSPECS: Grading System

~ 1969 by S.C. Werner

- Class 0: No signs or symptoms
- Class 1: Only signs, upper lid retraction
- Class 2: Soft Tissue Involvement with symptoms
- Class 3: Proptosis
- Class 4: BOM involvement
- Class 5: Corneal involvement
- Class 6: Sight Loss

~ Within classes 2 to 6 the investigator has to differentiate the severity grades 0, A, B, C

~ NOSPECS, classifies severity but not the activity or stage (active/inflammatory or passive/congestive)

~ Class 2-6 document severity

- 0: absent
- A: minimal
- B: moderate
- C: marked

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### NOSPECS: Grading System

- ~ 0: No symptoms or signs
- ~ 1: Only signs (upper lid retraction without lag lag or proptosis)
- ~ 2: Soft tissue involvement with symptoms (excess lacrimation, sandy sensation, retrobulbar discomfort)
  - Grade 0: absent
  - Grade A: minimal (edema of lids, injection, sandy feeling)
  - Grade B: moderate (edema of lids, injection, chemosis, FB, pain behind eyes)
  - Grade C: marked
- ~ 3: Proptosis associated with classes 2-6 only
  - Grade 0: absent
  - Grade A: minimal: 21mm-28mm
  - Grade B: moderate: 24mm-27mm
  - Grade C: marked: 28mm or more
  - Specify if inequality of mm between eyes, or if progression of mm under observation

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### NOSPECS: Grading System

- 4: EOM involvement (usually with diplopia)
  - 0: absent
  - A: minimal (limitation of motion, patient reports diplopia but no obvious restriction)
  - B: moderate (evident restriction of motion)
  - C: marked (position of globe is fixed)
- 5: Corneal involvement (due to proptosis, incomplete closure, lagophthalmos)
  - 0: absent
  - a: minimal (staining)
  - b: moderate (ulceration)
  - c: marked (clouding, necrosis, perforation)
- 6: Sight loss (due to optic nerve involvement)
  - 0: absent
  - A: minimal (disc pallor or edema, or VF defect, vision 20/20-20/60)
  - B: moderate (same as A but VA 20/70-20/200)
  - C: marked (blindness, VA < 20/200)

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### LEMO Classification

- 1991-Boergen and Pickardt
- Complements NOSPECS
- 4 finding-categories
  - Lid
  - Exophthalmos
  - Muscular
  - Optic nerve
- Grade between 0 and 4 depending on severity
- LEMO, classifies severity but not the activity or stage (active/inflammatory or passive/congestive)

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### LEMO Classification

Lid (L)	Exophthalmos (E)
<ul style="list-style-type: none"> <li>0: missing</li> <li>1: lid edema only</li> <li>2: real retraction (impaired lid closing)</li> <li>3: retraction and upper lid edema</li> <li>4: retraction and global lid edema</li> </ul>	<ul style="list-style-type: none"> <li>0: missing</li> <li>1: eye closing not impaired</li> <li>2: conjunctival injection in the morning</li> <li>3: persistent conjunctival injection</li> <li>4: corneal complications</li> </ul>

52

### LEMO Classification

Muscular (M)	Optic Nerve (O)
<ul style="list-style-type: none"> <li>0: missing</li> <li>1: detectable in imaging only</li> <li>2: Pseudoparesis</li> <li>3: Pseudoparalysis</li> </ul>	<ul style="list-style-type: none"> <li>0: missing</li> <li>1: regarding color vision only or detected via VEP</li> <li>2: peripheral scotoma</li> <li>3: central scotoma</li> </ul>

**LEMO200**  
Endocrine ophthalmopathy with lid edema, exophthalmos, pseudoparesis of external eye muscles, and no optic nerve involvement

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### Clinical Activity Score (CAS)

- Thyroid disease characterized by:
  - Severity
  - Activity – want 3 or above
  - CAS (1-7)
- Studies for Tepezza
- Payers using CAS for approval
  - Due to wide open label
  - Those infusing are charting the CAS

Clinical Activity Score	
1	Mild swelling behind globe
2	Moderate swelling behind globe
3	Swelling of eyelids
4	Swelling of conjunctiva
5	Chemosis
6	Conjunctival injection
7	Conjunctival injection with chemosis
8	Chemosis with conjunctival injection
9	Chemosis with conjunctival injection and lid edema
10	Chemosis with conjunctival injection and lid edema and conjunctival injection
11	Chemosis with conjunctival injection and lid edema and conjunctival injection and conjunctival injection

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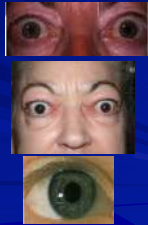
### Lid Involvement

- Lid Retraction
- Lid Lag
- Lagophthalmos

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### Lid Retraction

- ~ Scleral show in primary gaze
- ~ Most commonly seen complication
- ~ Occurs in ~90% of Graves' patients
  - Excess stimulation of Muller's muscle
  - Fibrosis inferior rectus
  - Mechanical restriction or infiltration of levator
  - Increased orbital volume causes exophthalmos
- ~ Normal Lid Position
  - Upper lid intersects cornea at the 2 and 10 o'clock positions
  - 2-3 mm below the limbus
  - Lower lid coincident or 1-2mm below the limbus



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### Eyelid Lag: von Graefe's Sign

- ~ Immobility or lagging of upper eyelid on downward gaze
- ~ Fibrosis of the inferior rectus muscle may induce lower lid retraction



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### Lagophthalmos

- ~ Inability to form a complete lid closure with a normal blink due to Exophthalmos/ Proptosis
- ~ Often leads to corneal exposure

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### Soft Tissue Involvement

- ~ Conjunctiva
- ~ Chemosis
- ~ Periorbital edema

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### Conjunctiva

- ~ Conjunctival and episcleral injection
  - Especially near the horizontal recti insertions
- ~ Chemosis
  - Edema of the conjunctiva and caruncle
- ~ Superior Limbic Keratoconjunctivitis
  - 65% correlation between SLK and systemic thyroid disease
  - Rheumatoid arthritis
  - IgGg4's syndrome



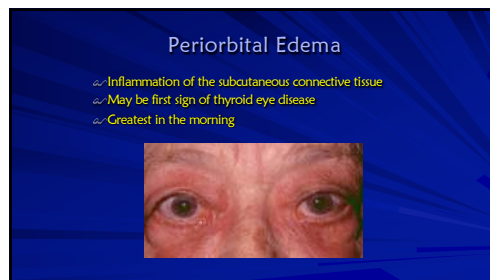
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### "If it is Red think TED"

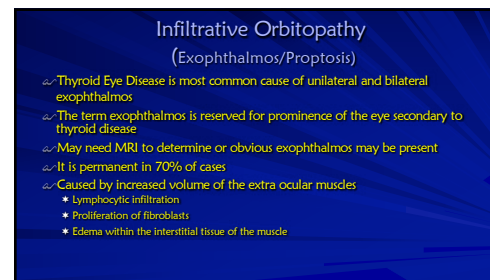
Dr. Andy Morgenstern 12/7/2013, OMS Contemporary Report



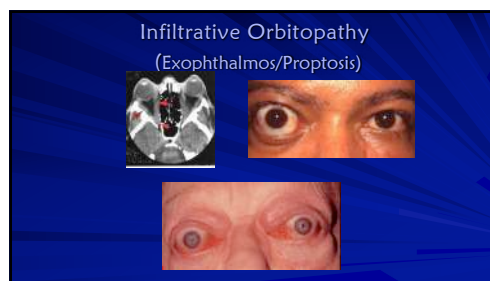
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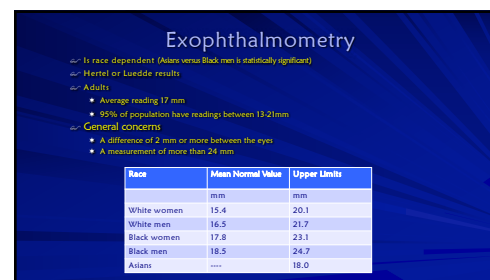
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### Restrictive Myopathy

- Secondary to edema and fibrosis of EOM's
- Inferior Rectus (IR) muscle is most commonly involved
- Occurs in 30-50% of patients
- Diplopia may be transient but in 50% it's permanent




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### IOP in Thyroid Eye Disease

- A rise in IOP has been reported with TED
- I would have higher suspicion when you see
  - Periorbital edema
  - Exophthalmos, proptosis
  - Restrictive myopathy
- Some literature reports IOP in up gaze to be part of the diagnoses of thyroid dysfunction

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### Restrictive Myopathy

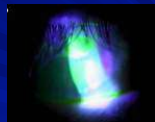


Obvious restrictive myopathy but also note the periorbital edema, and conjunctival hyperemia

70

### Corneal Exposure

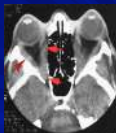

- Exposure keratopathy secondary to exophthalmos and lagophthalmos
- Significant threat to visual function



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### Optic Neuropathy

- Affects 5% of patients
- Usually mild to moderate exophthalmos and shallow orbits
- Enlargement of the recti muscles compresses ONH or its blood supply at the apex of the orbit
- Compression MAY occur without significant proptosis
- Compressive and/or ischemic and/or toxic

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### Treatment of Thyroid Eye Disease

- Depends on what phase of the disease we are in:
  - Phase secondary to abnormal thyroid hormone levels
  - Active "Inflammatory" phase
  - Plateau phase and Resolution "Passive" phase
- Depends on what orbital tissue or structures are involved
- Depends on the risk of vision loss
- Depends if primary, secondary or tertiary thyroid dysfunction
- Management consists of:
  - Control of inflammation
  - Prevention of ocular and visual damage
  - Addressing ocular motor abnormalities
  - Improving cosmetic disfigurement
- Patient education is essential
- Communication with an endocrinologist or internist will ensure proper patient care

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### Treatment of Thyroid Eye Disease

- ~ Palliative (hormone imbalance, active, passive)
  - Lubricants
  - Topical anti-inflammatory (Lotemax/Renaxol)
  - Prisms
- ~ Steroids (active phase)
  - Orals
  - Periocular injections
  - IV with oral steroid taper
- ~ Orbital radiotherapy (active phase)
- ~ Orbital Decompression (passive phase)
  - Fat removal orbital decompression (FROD)
    - Large orbits
  - Bone removal orbital decompression (BROD)
    - Small orbits
  - Both FROD and BROD



Smoking causes the thyroid eye disease to be more severe  
Smoking causes treatments to be less effective

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### Treatment of Thyroid Eye Disease

- ~ Paradigm shifts
  - Decrease in orbital radiotherapy
  - Waiting for passive stage but doing surgery
  - Increase usage of fat removal orbital decompression as first approach
  - Peri-orbital injection of steroids for recurrent disease after orals
- ~ Future
  - Looking for better or different ways to treat the active phase of this disease

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### Lid Retraction, Eyelid Lag, Lagophthalmos

- ~ Must treat underlying thyroid dysfunction
- ~ Abnormal hormone level and Active phase
  - Treat the exposure keratitis with lubricants
  - Tape eyelids shut at night
  - Lid weights
  - Moisture chamber at night
  - Antibiotic ointments
- ~ Passive Phase
  - Surgical Management
  - Inferior rectus recession
  - Mullerectomy
  - Recession of lower lid retractors



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### Lid Retractor Surgery



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### Conjunctiva, Periorbital edema


- ~ Topical lubricants
  - Artificial tears
  - Ointments at night
  - Topical steroids
  - Retaxol
- ~ Tape eyelids closed at night or use mask
- ~ Elevate head at night to decrease lid edema
- ~ Oral diuretics Acetazolamide
- ~ Oral steroids
  - 60-80mg/day for 3 months
- ~ IV steroids
- ~ Periocular steroids
  - Kenalog last 1 month



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### Infiltrative Orbitopathy (Exophthalmos/Proptosis)


- ~ Orbital Disease Consult
  - Systemic steroids to reduce inflammation
  - Low dose radiotherapy
  - Surgical orbital decompression



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### Restrictive Myopathy

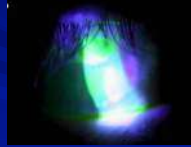
- Non-surgical (while waiting for stability)
  - Teach proper head position to alleviate diplopia
  - Prism in spectacle correction (fresnel or ground in)
  - Oral steroids
  - Botulinum toxin injection
- Surgical Consult
  - Recession of the rectus muscle(s) involved
  - Diplopia in primary gaze, reading gaze or both
  - Stable angle of deviation for at least 6 months
  - No evidence of active disease
  - Binocular vision in at least primary and reading positions



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### Corneal Exposure

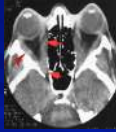

- Manage the corneal defect as first line
  - Lubricating and antibiotic
  - Lid taping
  - Moisture barrier
- Orbital Disease Consult
  - High dose oral steroids
    - 120-140mg/day x 7 days
  - Orbital decompression



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### Optic Neuropathy

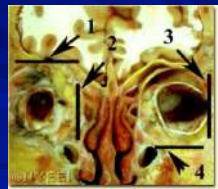
- Systemic Steroids
  - If rapidly progressive and painful in the early stage of the disease
  - Only if no contraindications
  - Prednisolone 80-100mg, expect results within 48hrs. Taper dose and d/c within 3 mo
- IV Methylprednisolone
- Radiotherapy: if contraindication to steroid
- Orbital decompression

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### Orbital Decompression

- Not effective if no medical treatment
  - Two-wall decompression
    - 3-6 mm retroplacement of the globe
  - Three-wall decompression
    - 6-10mm retroplacement
  - Four-wall decompression
    - 10-15mm retroplacement



83

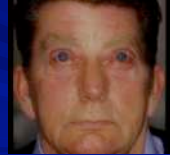
### Orbital Decompression (Surgical/Cosmetic)



84

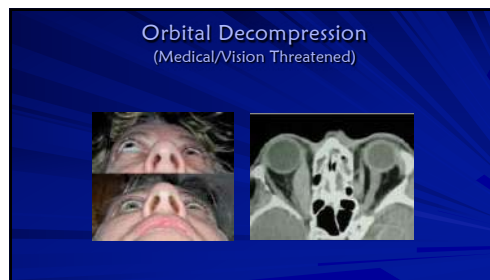
### Thyroid Eye Disease and Depression

- When facial disfigurement occurs, thyroid eye disease is equivalent to the diagnosis of cancer and AIDS

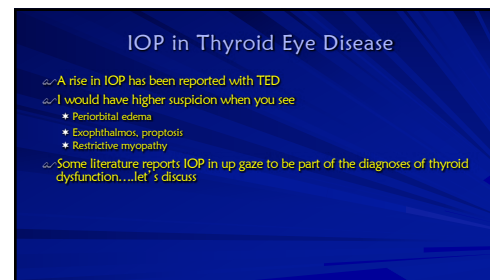


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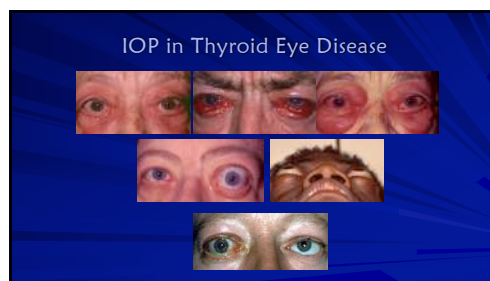




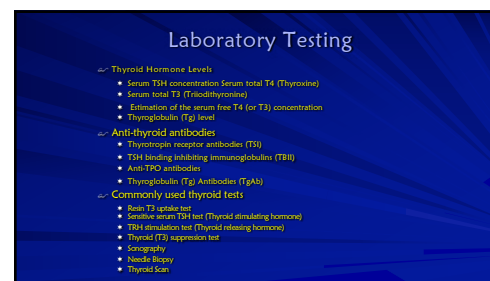
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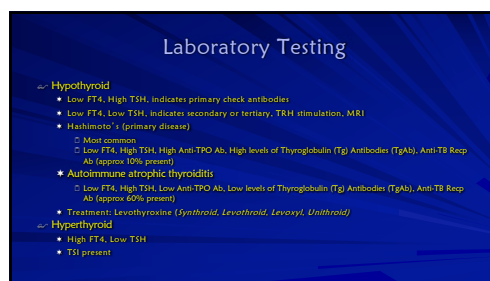
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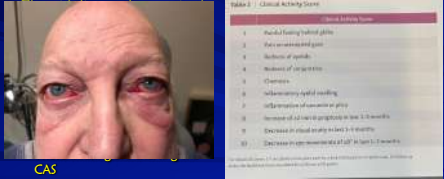


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Clinical Activity Score (CAS)



CAS

Clinical Activity Score	
1	Mild swelling of eyelids
2	Moderate swelling of eyelids
3	Severe swelling of eyelids
4	Severe swelling of eyelids with inflammation of conjunctiva or sclera
5	Severe swelling of eyelids with inflammation of conjunctiva or sclera and pain
6	Severe swelling of eyelids with inflammation of conjunctiva or sclera and pain and photophobia
7	Severe swelling of eyelids with inflammation of conjunctiva or sclera and pain and photophobia and tearing
8	Severe swelling of eyelids with inflammation of conjunctiva or sclera and pain and photophobia and tearing and discharge
9	Severe swelling of eyelids with inflammation of conjunctiva or sclera and pain and photophobia and tearing and discharge and vision loss
10	Severe swelling of eyelids with inflammation of conjunctiva or sclera and pain and photophobia and tearing and discharge and vision loss and double vision
11	Severe swelling of eyelids with inflammation of conjunctiva or sclera and pain and photophobia and tearing and discharge and vision loss and double vision and diplopia
12	Severe swelling of eyelids with inflammation of conjunctiva or sclera and pain and photophobia and tearing and discharge and vision loss and double vision and diplopia and strabismus
13	Severe swelling of eyelids with inflammation of conjunctiva or sclera and pain and photophobia and tearing and discharge and vision loss and double vision and diplopia and strabismus and exophthalmos
14	Severe swelling of eyelids with inflammation of conjunctiva or sclera and pain and photophobia and tearing and discharge and vision loss and double vision and diplopia and strabismus and exophthalmos and optic atrophy
15	Severe swelling of eyelids with inflammation of conjunctiva or sclera and pain and photophobia and tearing and discharge and vision loss and double vision and diplopia and strabismus and exophthalmos and optic atrophy and blindness

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February 25, 2019  
"Nothing Else Can Be Done"



93

February 25, 2019  
"Nothing Else Can Be Done"



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March 1, 2019 (4 days later)  
Oral and Topical Steroids



95

March 1, 2019 (4 days later)  
Oral and Topical Steroids



96

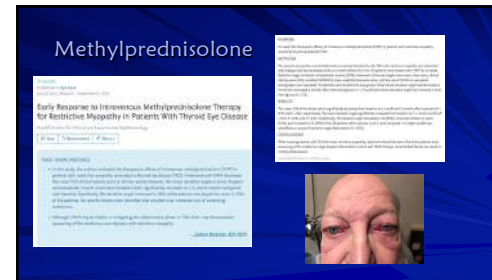
March 1, 2019 (4 days later)  
Oral and Topical Steroids



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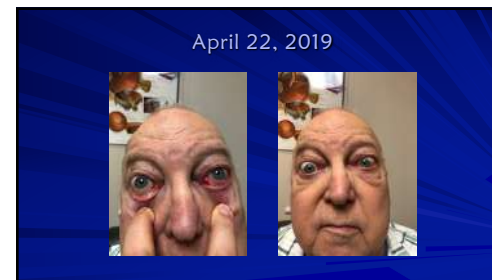
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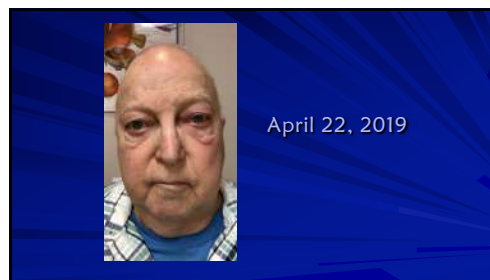
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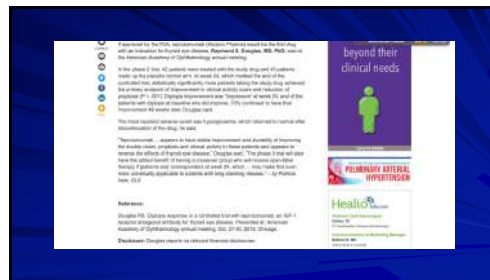
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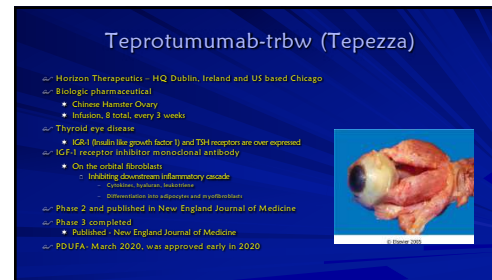
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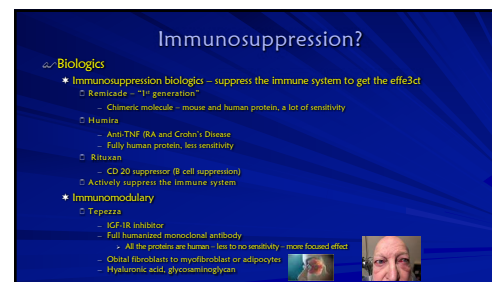
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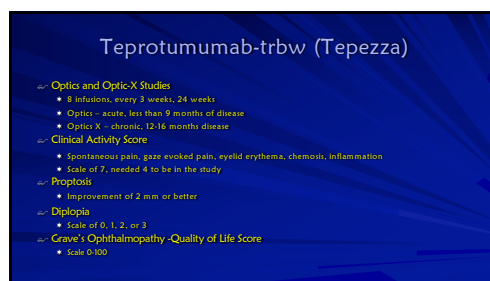
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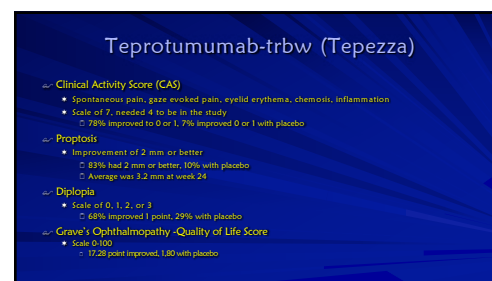
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### Teprotumumab-trbw (Tepezza)

⚡ **Adverse Reactions**

- ★ **Very well tolerated**
- ★ The most common adverse reactions (incidence ≥5% and greater than placebo) are muscle spasm, nausea, alopecia, diarrhea, fatigue, hyperglycemia, hearing impairment, dysgeusia, headache, and dry skin.

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### Teprotumumab-trbw (Tepezza)

⚡ **Infusion Reactions (mild/moderate):** approximately 4% of patients

- ★ transient increases in blood pressure, feeling hot, tachycardia, dyspnea, headache, and muscular pain
- ★ consideration should be given to premedicating with an antihistamine, antipyretic, or corticosteroid and/or administering at a slower infusion rate.

⚡ **Hyperglycemia:** Increased blood glucose or hyperglycemia

- ★ In clinical trials, 10% of patients experienced hyperglycemia
- ★ Monitor patients for elevated blood glucose and symptoms of hyperglycemia while on treatment with teprotumumab
- ★ Patients with preexisting diabetes should be euglycemic before beginning treatment

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### Teprotumumab-trbw (Tepezza)

⚡ **Infusion center:**

- ★ Go to Horizon website
- ★ Contact Us
- ★ Type in your question
  - Looking for infusion center


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### Biologics Used Off Label for TED

Drug/Indication	Target	Indication	Notes
Interferon-α	Interferon-α	Graves' disease	Approved for Graves' disease
Interferon-β	Interferon-β	Graves' disease	Approved for Graves' disease
Interferon-γ	Interferon-γ	Graves' disease	Approved for Graves' disease
Interferon-δ	Interferon-δ	Graves' disease	Approved for Graves' disease
Interferon-ε	Interferon-ε	Graves' disease	Approved for Graves' disease
Interferon-ζ	Interferon-ζ	Graves' disease	Approved for Graves' disease
Interferon-η	Interferon-η	Graves' disease	Approved for Graves' disease
Interferon-θ	Interferon-θ	Graves' disease	Approved for Graves' disease
Interferon-ι	Interferon-ι	Graves' disease	Approved for Graves' disease
Interferon-κ	Interferon-κ	Graves' disease	Approved for Graves' disease
Interferon-λ	Interferon-λ	Graves' disease	Approved for Graves' disease
Interferon-μ	Interferon-μ	Graves' disease	Approved for Graves' disease
Interferon-ν	Interferon-ν	Graves' disease	Approved for Graves' disease
Interferon-ξ	Interferon-ξ	Graves' disease	Approved for Graves' disease
Interferon-ο	Interferon-ο	Graves' disease	Approved for Graves' disease
Interferon-π	Interferon-π	Graves' disease	Approved for Graves' disease
Interferon-ρ	Interferon-ρ	Graves' disease	Approved for Graves' disease
Interferon-σ	Interferon-σ	Graves' disease	Approved for Graves' disease
Interferon-τ	Interferon-τ	Graves' disease	Approved for Graves' disease
Interferon-υ	Interferon-υ	Graves' disease	Approved for Graves' disease
Interferon-φ	Interferon-φ	Graves' disease	Approved for Graves' disease
Interferon-χ	Interferon-χ	Graves' disease	Approved for Graves' disease
Interferon-ψ	Interferon-ψ	Graves' disease	Approved for Graves' disease
Interferon-ω	Interferon-ω	Graves' disease	Approved for Graves' disease

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### Optometry's Opportunity



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### Eyelash and Brow Loss

⚡ Hypothyroidism or hyperthyroidism, hair loss can be an unfortunate side effect

⚡ Dry, brittle hair, thinning on the scalp, and even loss of lashes and brows

⚡ Some drugs used to treat thyroid conditions can also contribute to the loss of hair

⚡ Left untreated, the hormonal changes associated with hypothyroidism or hyperthyroidism can completely stop new hair strands from developing



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### Current Treatments



- ~ Latisse – bimatoprost 0.03%
- ~ Lash Boost – Rodan Fields - contain isopropyl cloprostenate
  - Synthetic analog of the medication found in Latisse.
  - Highly potent prostaglandin F2-alpha receptor agonist



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### New and All Natural


- ~ Lash and Brow Serum – Nu Colour – Nu Skin
  - June 22, 2023 – Available in USA
  - Formulation of natural extracts and peptides
  - Prostaglandin free
  - BAK free
  - No Rx needed – sold in the office
  - Clinical studies performed

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### Lash and Brow Serum

- ~ No Prostaglandin analogs
  - 3 peptides and 5 extracts
- ~ No iris or skin color changes
- ~ No BAK
  - No impact to dry eye
- ~ Not a prescription
- ~ Safe for contact lens wears
- ~ Works within 4 weeks
- ~ 1 bottle (5 ml) lasts 2-3 months
- ~ 3-year shelf life
- ~ Favorable pricing and profitability
- ~ Able to offer a safer solution to the patient
- ~ Able to capture a part of this \$1.7 billion USD market
- ~ Resources for your office – posters and banners



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### New and All Natural



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### Functional Interventions

Immune System Support  
Gut Microbiome Support

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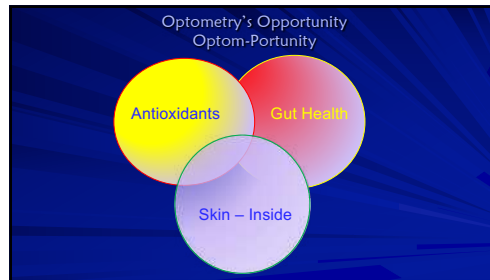
### Key Tenants of Aging, Performance and Vitality

- Oxidative Stress / Inflammation
- Hormonal Balance
- Stress Hormones
- Glucose / Insulin Regulation
- GUT integrity and microbiome diversity
- Immune Balance
- Environmental Exposure/Burden
- Individuality

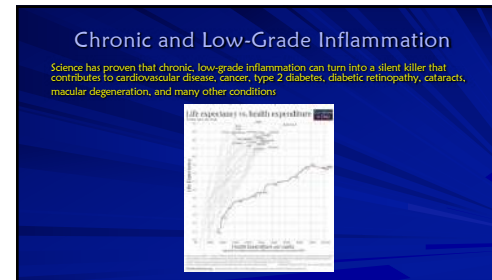
Credit to: James LaVelle, NPH, DCS

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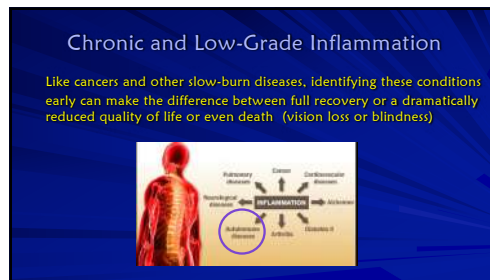




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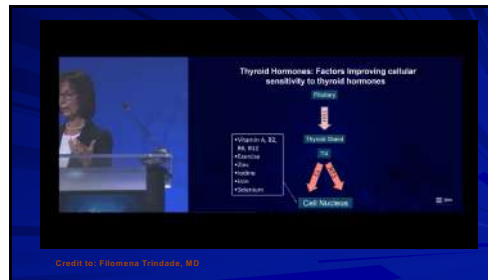
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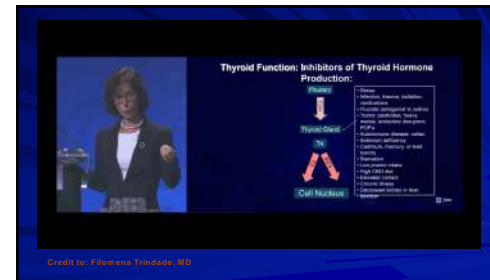
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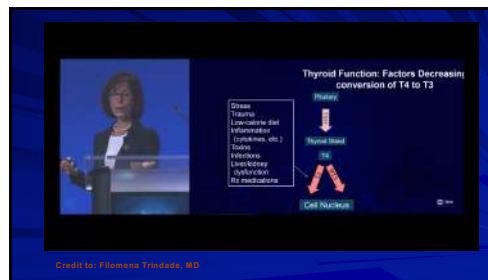
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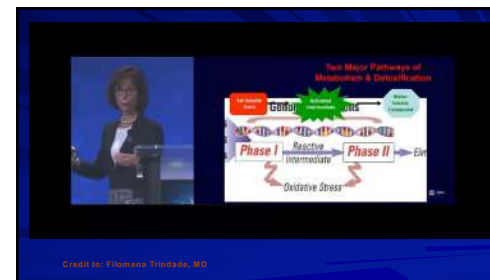
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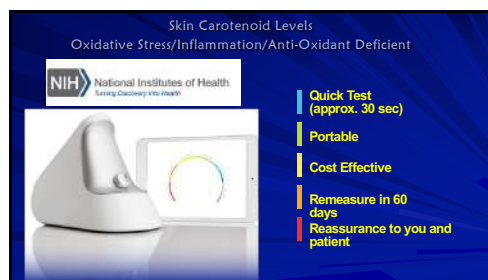
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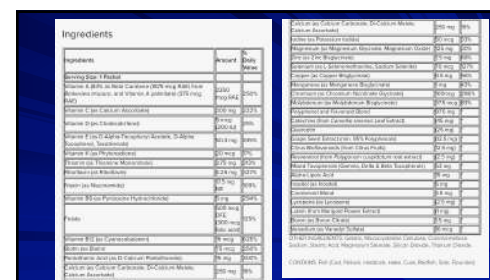
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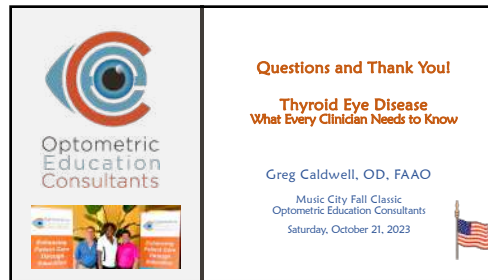


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