
بسم الله الرحمن الرحيم

Dry eyes

Dr Nazullah

Associate professor

Ophthalmology kgmc/hmc

Dry eyes/ Keraocunjuctivitis sicca

- Is a condition in which there is insufficient secretion of aqueous tear to maintain the normal tear film

- Is a condition in which pre corneal tear film is deficient due to its decreased production or increased evaporation, leading into unstable tear film and ocular surface diseases

Contd two main types

- Can be divided in two main types

- Aqueous production deficiency

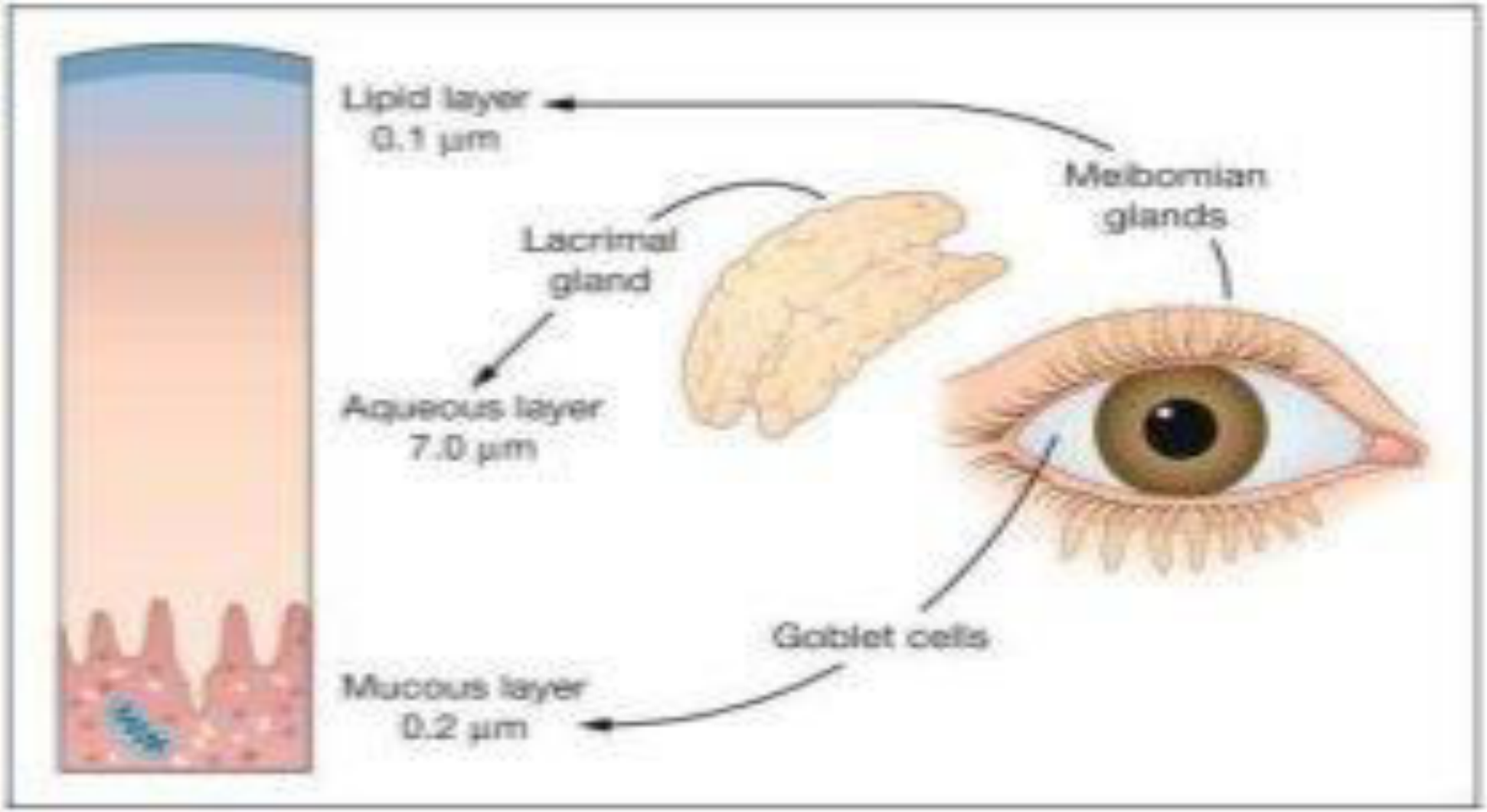
- Evaporative Tear dysfunction

Tear production

- Main lacrimal gland; main tear production 90-95% is by the main lacrimal gland . Basic production is by the accessory lacrimal glands of Krause & Wolfring, present in the conjunctival sac.

- Accessory lacrimal glands are in the conjunctiva. It produces the basic tears in the resting condition
- Normal volume 3.4 -10.7 microliter
- Normal rate in resting 1.2-2.2 microliter/mint

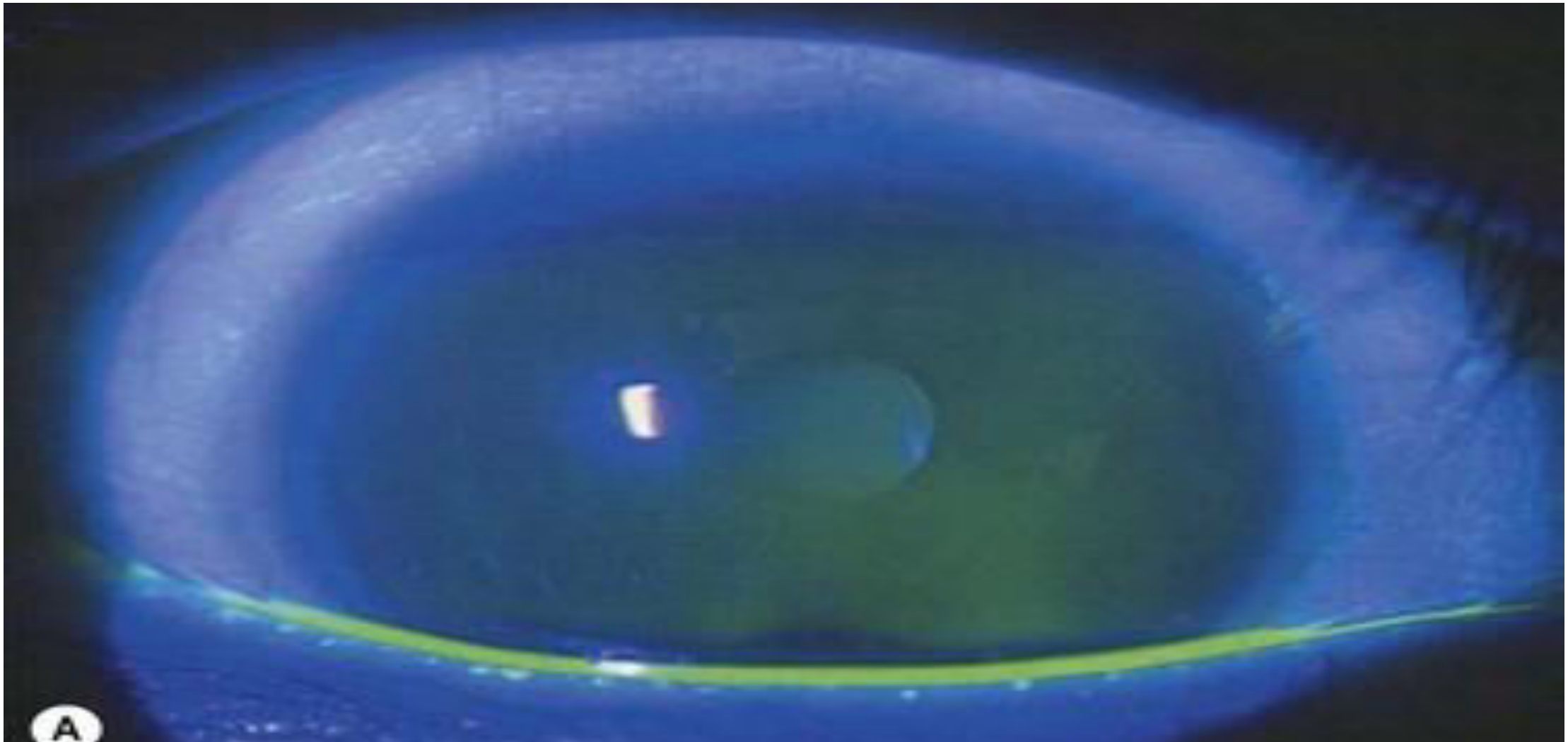
Tear film


Lipid layer
0.1 µm
Meibomian glands
Lacrimal gland
Aqueous layer
7.0 µm
Goblet cells
Mucous layer
0.2 µm

Layers of the tears

- Lipid layer; it is the outer/superficial layer of the tears which prevents the evaporation of tear film. Meibomian glands are responsible for its production.
- Aqueous layer; which is the main bulky layer 70-80% of tear film. It is the central main part of the tears and does the main function of it. It is secretd by the lacrimal gland(main +accessory gland). Major constituent is the water & minerals. It gives nutrition's and oxygen flow to the corneal avascular surface.
- Mucin layer; is the third and inner most layer of the tear. It is produced by the goblet cells/gland of the conjunctiva. It maintains attachment of the tear to the cornea by making the corneal surface sticky.

Normal precorneal tear film



A. Aqueous production deficiency

Keratoconjuctivitis sicca

- Pure Sicca syndrome; in which only the lac glands are involved
- Congenital Alacrimia
- Denervation hyposecretion such as surgery on Trigeminal gangelion
- Idiopathic hyposecretion

Sjogren syndrome

- Primary, Is an autoimmune condition in which antibodies are produced against the lacrimal gland and salivary glands leading to its inflammation & destruction without any systemic associations, and to decrease secretion of tears and leading to dry eyes & dry mouth syndromes
- Secondary, when the dry eyes are associated with systemic autoimmune disorder such as
- Rheumatoid arthritis
- Systemic lupus erythmatous

Non Sjogren sydrome

- Is a dry eye condition caused by non autoimmune conditions such as
- Trauma, Chemical thermal radiation
- Infection, trachoma
- Inflammation, like sarcoidosis, thyroid eye diseases
- Hypersensitivity, like steven Johnson syndrome
- Tumor, benign & malignant tumors of the Lacrimal gland
- Secondaries, like Leukemias and Lymphomas.

B. Evaporative causes

- Post blepharitis
- Atopc keratoconjuctitis sicca
- Sever proptosis
- Facial nerve palsy
- Eyelid scarring following blepharoplasty
- Contact lens wear

Clinical features

Photophobia, dryness, grittiness, & Foreign body sensation that becomes worse in sun , windy and hot climates

Pain with blinking & stringy mucus discharge & some blurring of vision

Examination will show Foreign bodies

Very thin tear film, almost absent.

Flouresene stain will shows very thin tear film

Rose bengal stain positive cornea with mucin filament attached to the corneal surface

Dry Eye Severity Grading Scheme

Dry Eye Severity Level	1	2	3	4*
Discomfort, severity and frequency	Mild and/or episodic; occurs under environmental stress	Moderate episodic or chronic stress or no stress	Severe, frequent or constant without stress	Severe and/or disabling and constant
Visual symptoms	None or episodic mild fatigue	Annoying and/or activity limiting episodic	Annoying, chronic and/or constant, limiting activity	Constant and/or possibly disabling
Conjunctival injection	None to mild	None to mild	+/-	+/++
Conjunctival staining	None to mild	Variable	Moderate to marked	Marked
Corneal staining (severity/location)	None to mild	Variable	Marked central	Severe punctate erosions
Corneal/tear signs	None to mild	Mild debris, ê meniscus	Filamentary keratitis, mucus clumping, é tear debris	Filamentary keratitis, mucus clumping, é tear debris, ulceration
Lid/meibomian glands	Meibomian gland disease (MGD) variably present	MGD variably present	Frequent	Trichiasis, keratinization, symblepharon
Tear film break-up time	Variable	≤ 10 seconds	≤ 5 seconds	Immediate
Schirmer score (per five min.)	Variable	≤ 10mm	≤ 5mm	≤ 2mm

* Must have signs *and* symptoms.

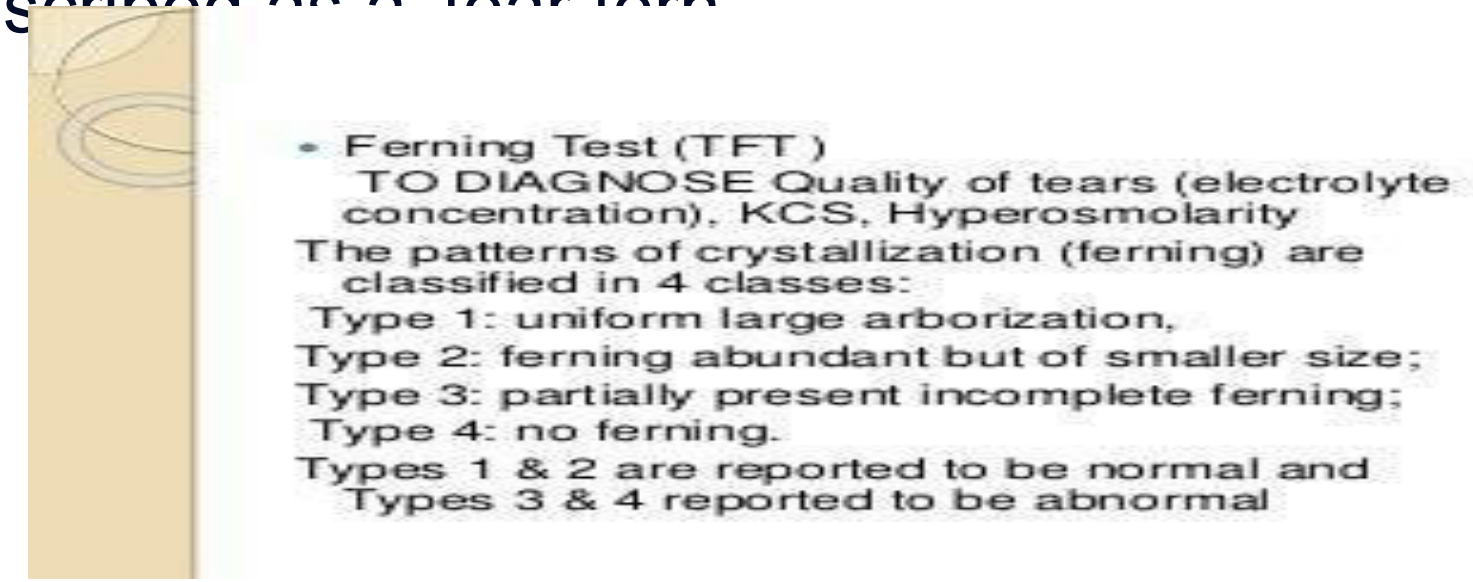
Source: Behrens A, Doyle JJ, Stern L,et al; Dysfunctional tear syndrome study group. Dysfunctional tear syndrome: a Delphi approach to treatment recommendations. Cornea. 2006 Sep;25(8):900-7.

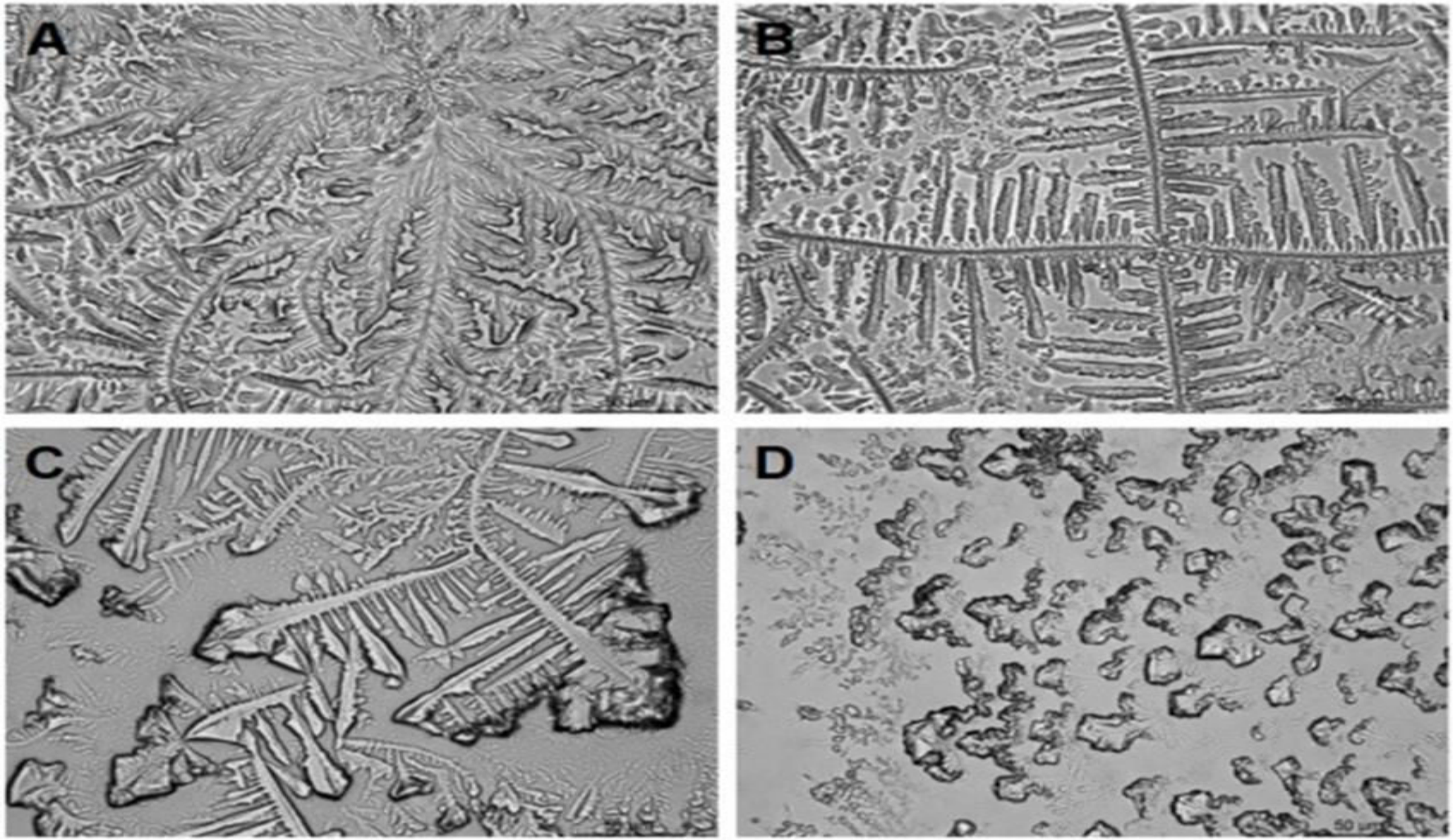
Diagnosis / investigation

- Slit lamp examination;
- Tear film break up time, will be reduced. Normal is 15-20 seconds.
- will show absent/ thin tear film, filaments attached to cornea
- Flourosene stain. Very thin tear film
- Rose bengal stain will shows mucus filament attach to the cornea
- Schirmer test shows very mild cases of dry conditions . In this condition whatman filter paper is placed in the conjunctival sac for 05 mints. Normal 15mm, moderate is 6-10mm. In dry eyes it is less then 06 mm
- Impression Cytology , detects the goblet cells which are reduced in dry eyes

Fern test

- The tear ferning test is a laboratory test but it has the potential to be applied in the clinic setting to investigate the tear film in a simple way. Drying a small sample of tear fluid onto a clean, glass microscope slide produces a characteristic crystallisation pattern, described as a 'tear fern'
-




A
B
C
D

Tear ferning test classification

- (Rolando's classification).
- Type 1: uniform arborization in the entire field of observation without spaces between the ferns. Single ferns are big and closely branched (A).
- Type 2: Arborization is abundant, but the single ferns are smaller and have a lower frequency of branching than in grade 1; empty spaces appear between the ferns (B).
- Type 3: Single ferns are little and incompletely formed with rare or no branching (C).
- Type 4: No ferning is present; mucus may appear in clusters and threads (D).
-

- Impression Cytology

-

- Brush Cytology Technique

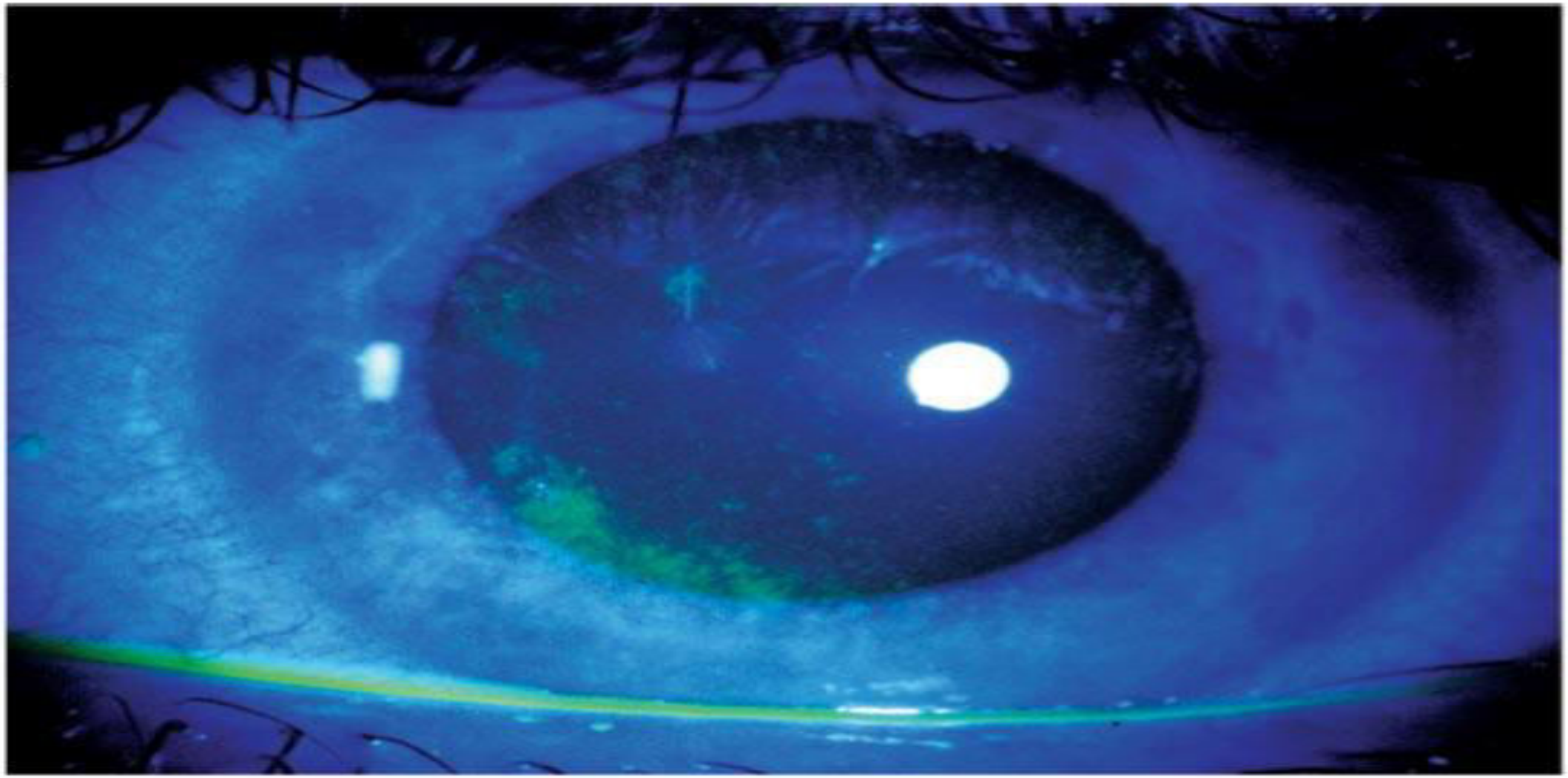
1) squamous metaplasia,
2) detecting inflammatory cells
3) expression of several surface markers on the ocular surface epithelium

- Flow cytometry in impression cytology

HLA DR expression by epithelial cells, gold standard for inflammatory assesment

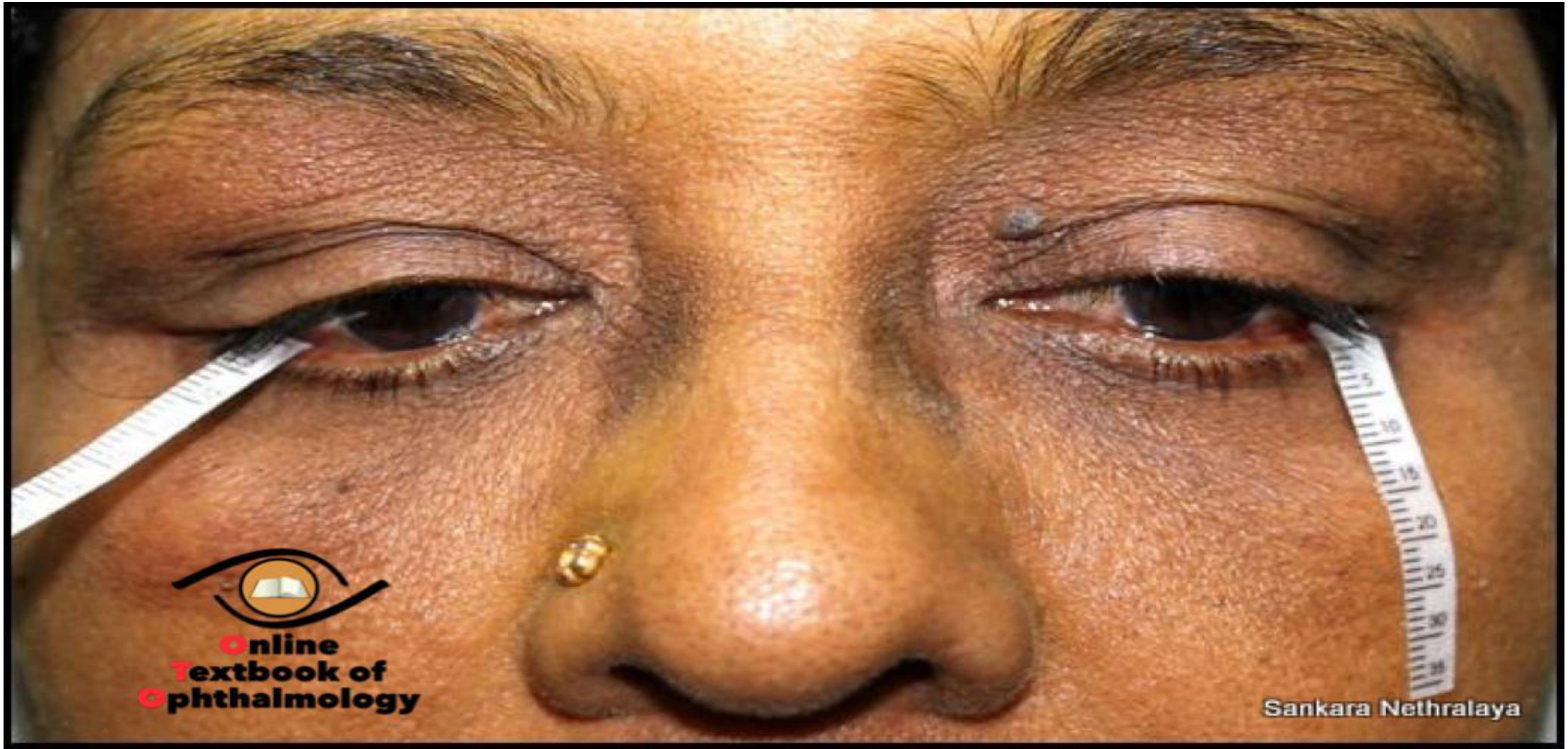
- The technique of impression cytology was established by Egbert et al in 1977 for studying goblet cells.
- The basic principle of impression cytology is the application of cellulose acetate filter paper to the ocular surface for the collection of superficial layers lining the ocular surface following which histological, immunohistological, or molecular analysis of the cells can be done.
- Impression cytology is a very useful, relatively non-invasive tool for assessing ocular surface in various dry eye disorders, such as keratoconjunctivitis sicca (KCS), cicatricial ocular pemphigoid, and vitamin A deficiency.

J. Daniel Nelson, MD



Punctate epithelial erosions in an eye stained with fluorescein.

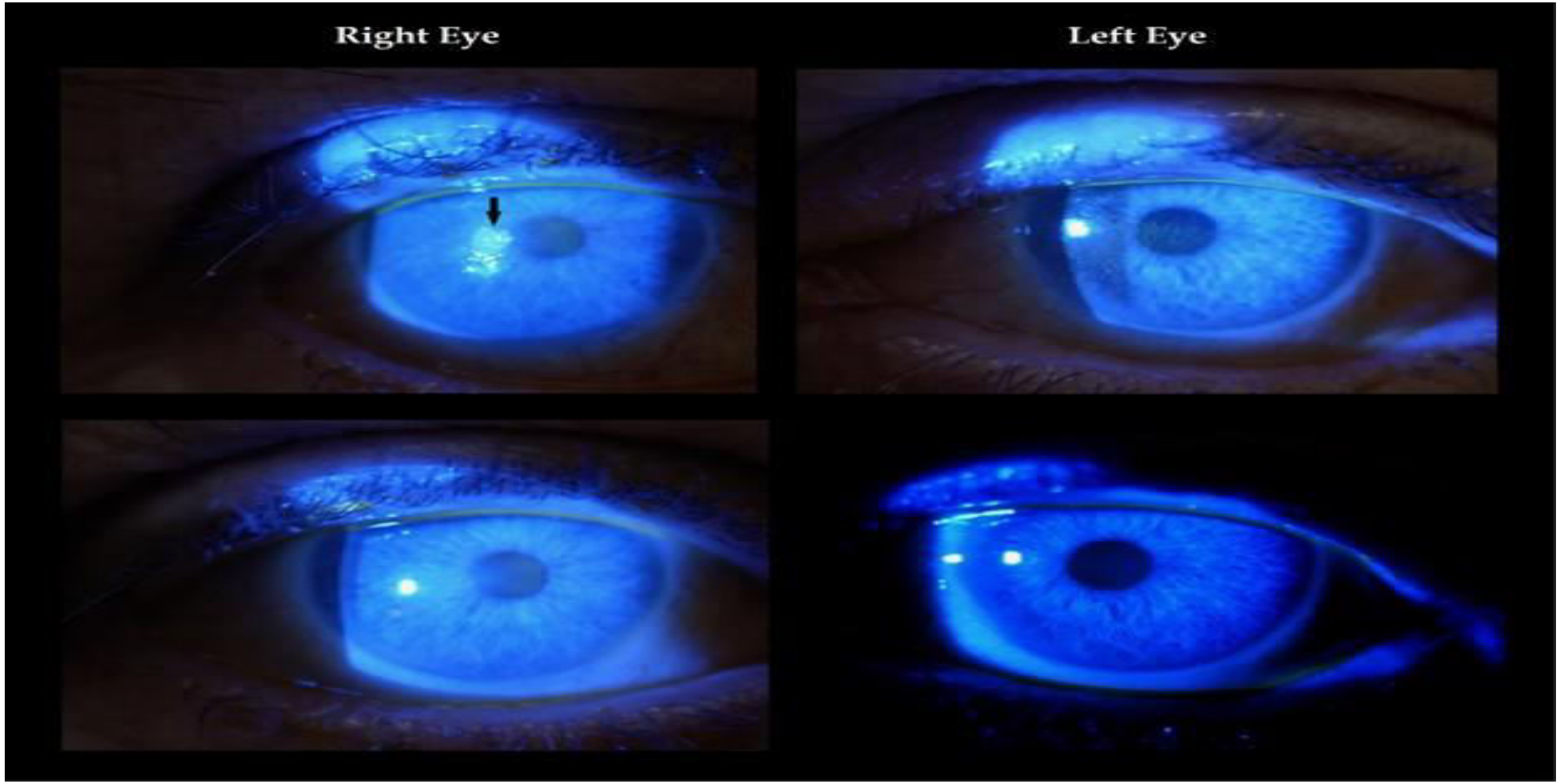
Schirmer test



Treatment, Conservative/ Surgical

- Conservative
- Tear substitute eye drops mainstay of treatment such as
- Methyle cellulose, polyvinyle alchohol, sodium hyalorunat
- Topical steroid & topical mucolytic such as Acetylcystein for dispersing mucus threads
- Autologus serum, which contains growth factor & vitamin A etc etc
- Topical cyclosporin eye drops
- Soft contact lenses, which traps the fluid behind it & make the surface smooth

Fingerprick autologous blood for dry eyes and persistent epithelial defects. Top: fluorescein-stained PED (arrow) of the right cornea and punctate staining of the left cornea at presentation. Bottom: healed PED of the right cornea and resolution of punctate staining on the left on day 4 of FAB treatment.



- Top: fluorescein-stained PED (arrow) of the right cornea and punctate staining of the left cornea at presentation. Bottom: healed PED of the right cornea and resolution of punctate staining on the left on day 4 of FAB treatment.\
- PED Persistent Epithelial Defect
- FAB finger prick Autologous Blood

Normal tear film

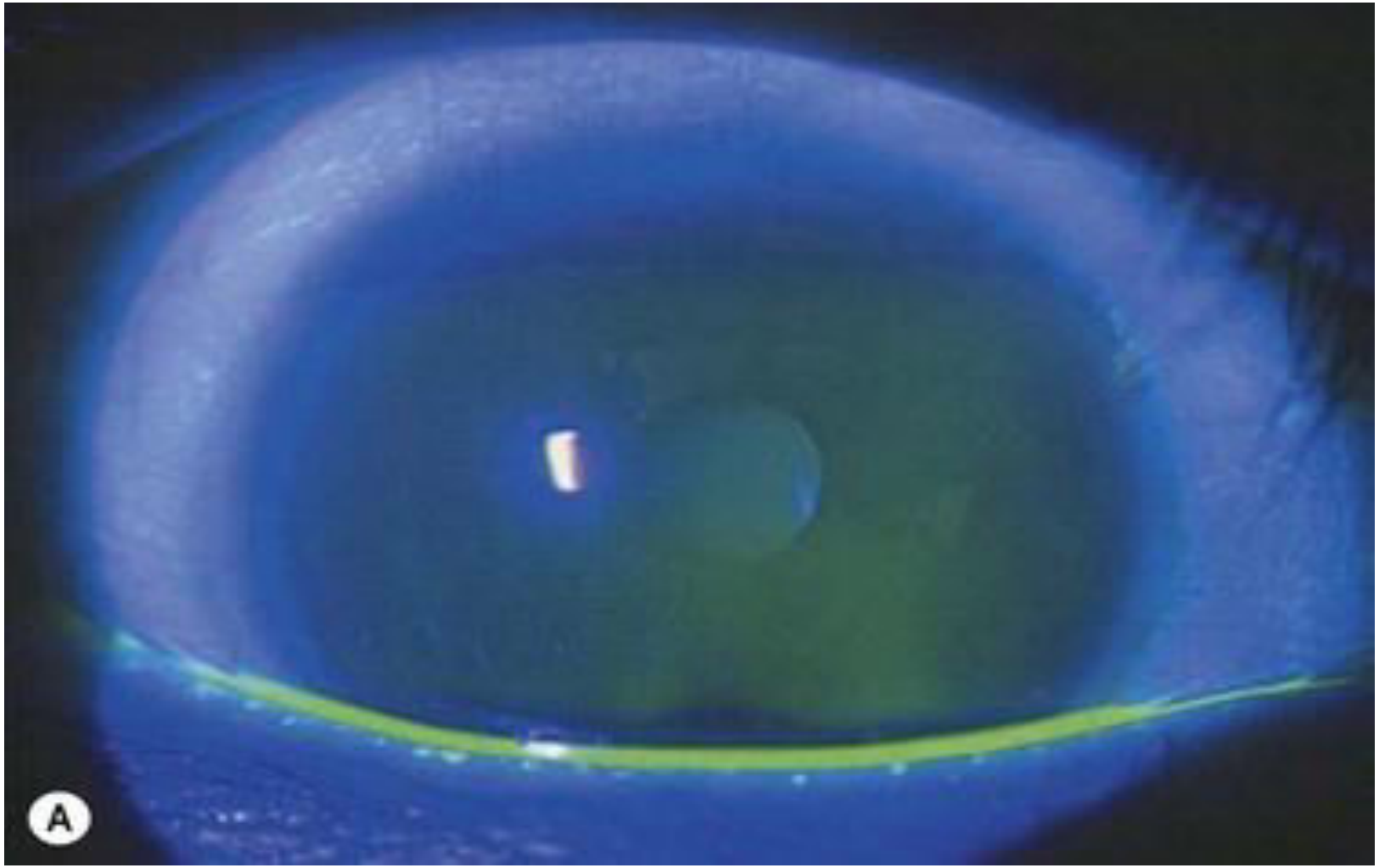
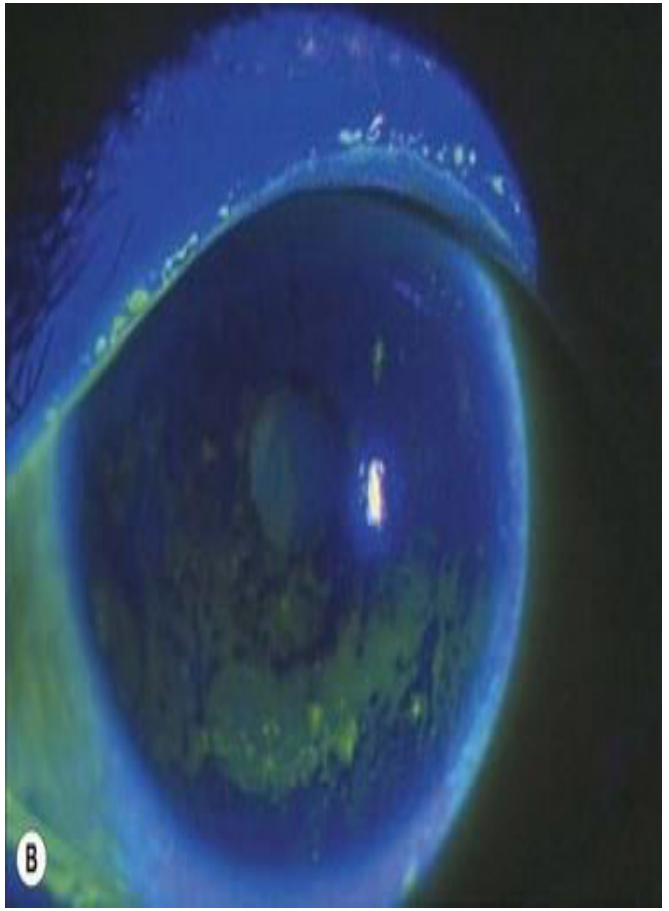
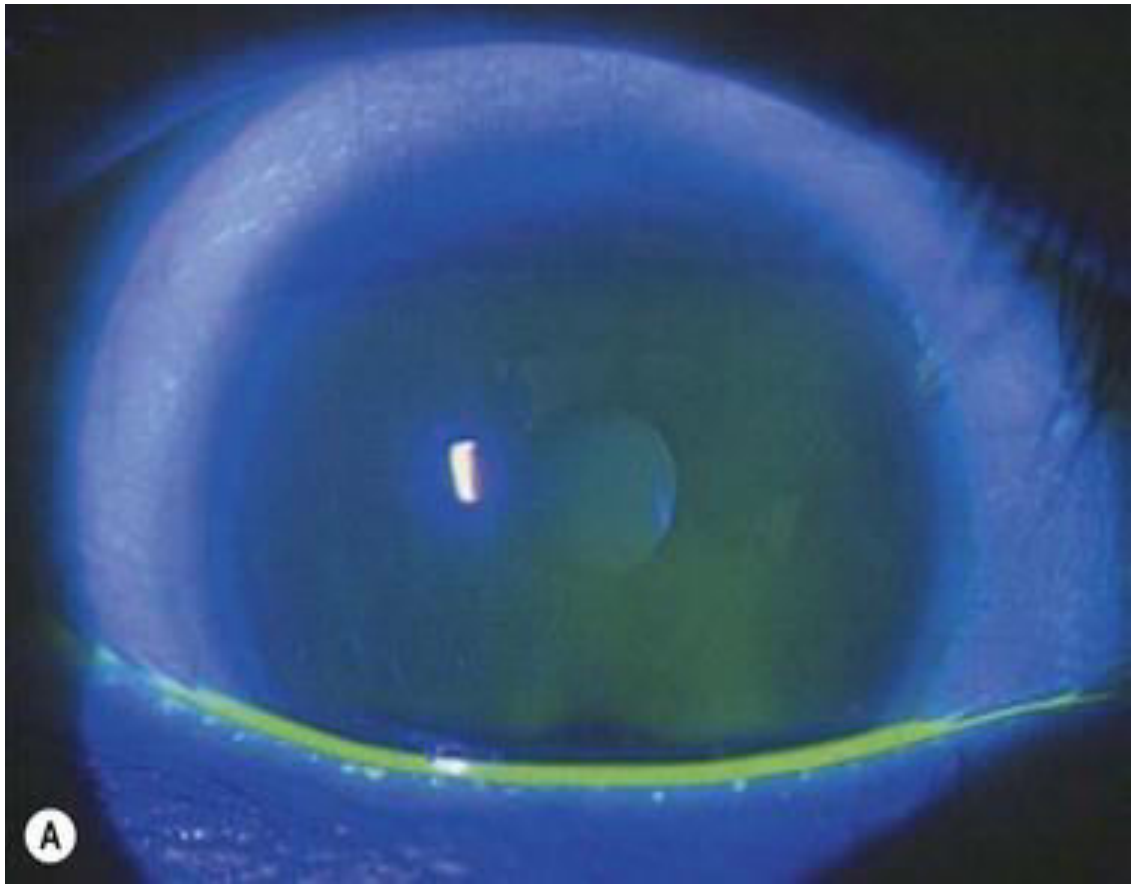


FIGURE 3.1 Slit lamp photographs with fluorescein staining of a representative dry eye patient and a normal subject. **(A)** Twenty-six-year-old male normal subject. Estimated tear film thickness was 6.4 μm. **(B)** Thirty-six-year-old female dry eye patient with Sjögren syndrome. Estimated tear film thickness was 2.4 μm. Am J Ophthalmol 2011;151:18–23.e1.)

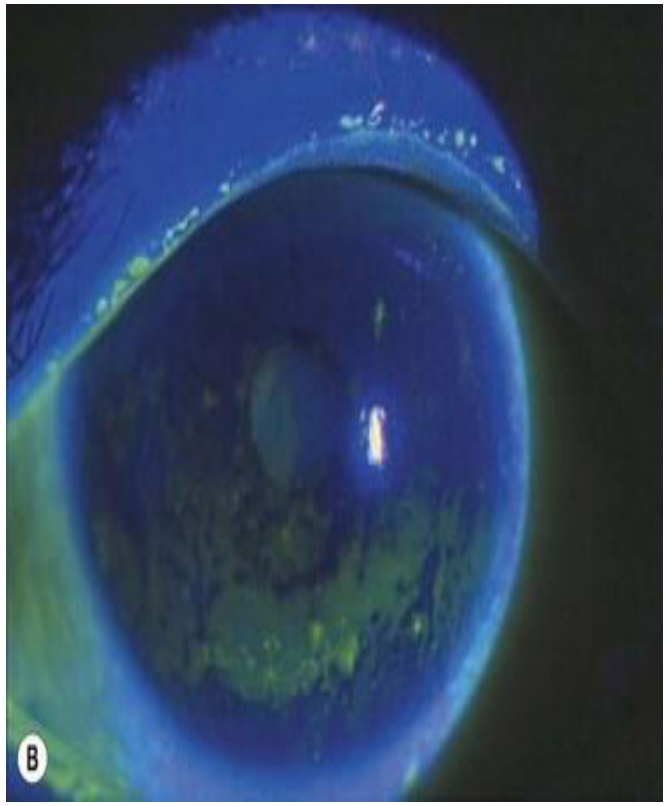


- Tear film

- Normal 6.4micron
-



- Dry eyes
- Tear film 2.5 micron



- Surgery
- Punctal Plugs to reduce the tear drainage
- Surgical transplantation of parotid duct into conjunctival sac

- Tear plugs

B. Tear Retention
1. Punctal Occlusion

Types

- absorbable and nonabsorbable. The former are made of collagen or polymers and last for variable periods of time (3 days-6 mnths).
- The nonabsorbable "permanent" plugs include silicon plugs, consists of a surface collar resting on the punctal opening, a neck, and a wider base
- Herrick plug is shaped like a golf tee and is designed to reside within the canaliculus.
- cylindrical Smart plug: expands and increases in diameter in situ, due to thermodynamic properties of its hydrophilic acrylic composition.

Vitamin A deficiency Xerophthalmia

- It is a spectrum of ocular conditions caused by vitamin A deficiency.
- The leading cause of childhood blindness
- Responsible for 20,000 to 100,000 new cases of blindness in the world, each year
- It may be caused by Malnutrition, Malabsorption, Chronic diarrhea loose motion, Chronic alcoholism and or due highly selected diet.

WHO Report

- Vitamin A Deficiency is among the leading causes of blindness
- worldwide, estimated to blind half a million children each year.
- Although VAD is rarely seen in developed countries, it remains a
- public health concern in more than half of all countries, mostly
- affecting young children in impoverished regions.

- The World Health Organization (WHO) estimates that 228 million
- children have VAD, causing 1-3 million childhood deaths and 5-10
- million cases of eye disease.

- VAD is especially prevalent in Africa and South-East Asia, where young children and pregnant
- women in low-income countries are disproportionally affected.
- In the United States, VAD is rare. In 2013, it was estimated at 0.3%. VAD usually involves a malabsorptive process, such as
- inflammatory bowel disease or post-gastric bypass surgery, or a
- severely restrictive diet.

Reduced intake of Vitamin A	Impaired absorption of Vitamin A	Reduced Storage of Vitamin A
•Inadequate food supply •Chronic alcoholism •Highly selective dieting •Dysphagia •Mental illness	•Crohn's disease •Celiac disease •Pancreatic insufficiency •Short bowel syndrome •Chronic diarrhea •Inflammatory bowel disease •Upper gastrointestinal surgery •Giardiasis •Abetalipoproteinemia	•Liver disease •Cystic fibrosis

Mechanism

- Vitamin A is a fat-soluble vitamin that humans derive primarily from diet. It has several essential functions in the body, including cell development, metabolism, immune function, vision, and reproductive function.
- The columnar epithelium of the mucus membrane undergoes squamous metaplasia with the loss of goblet cells, which results in dryness of conjunctiva, cornea & corneal ulceration leading to keratomalacia and perforation and blindness.
- In retina there is reduced formation of photoreceptor visual pigment resulting into night blindness.

- In the eye, Vitamin A is essential for maintenance of conjunctival and corneal epithelia as well as night vision.
- VAD causes metaplasia and keratinization of mucus-secreting epithelium, which can cause conjunctival and corneal xerosis, corneal ulcers, keratomalacia, and corneal scarring.
- Rods are the retinal photoreceptor that is responsible for night vision. Rods have a singular photopigment, rhodopsin. Retinol is a vitamin A-derived cofactor that is required for the formation of rhodopsin; thus, VAD leads to impairment of rod function and causes nyctalopia, or night blindness due to the eye's inability to adapt from light to dark[7].
-

Normal daily requirement of Vitamin A

- The recommended dietary allowance of vitamin A is 700ug/day in females and 900ug/day in the males.
- For children and pregnant or lactating women, the recommended amount is 300-900, 770, and 1300ug/day, respectively.
- Children aged 1-5 years old require a minimum of 200ug/day to prevent symptomatic VAD[

- Dietary sources of preformed vitamin A include dark leafy greens, orange-colored vegetables, fish liver oils, liver, egg yolks, butter, and vitamin A-fortified dairy products. A variety of other foods contain beta-carotene and other provitamin carotenoids, which get converted into vitamin A. These include green leafy and yellow vegetables, carrots, and deep- or bright-colored fruits.
- 80-90% of vitamin A is stored in the Liver

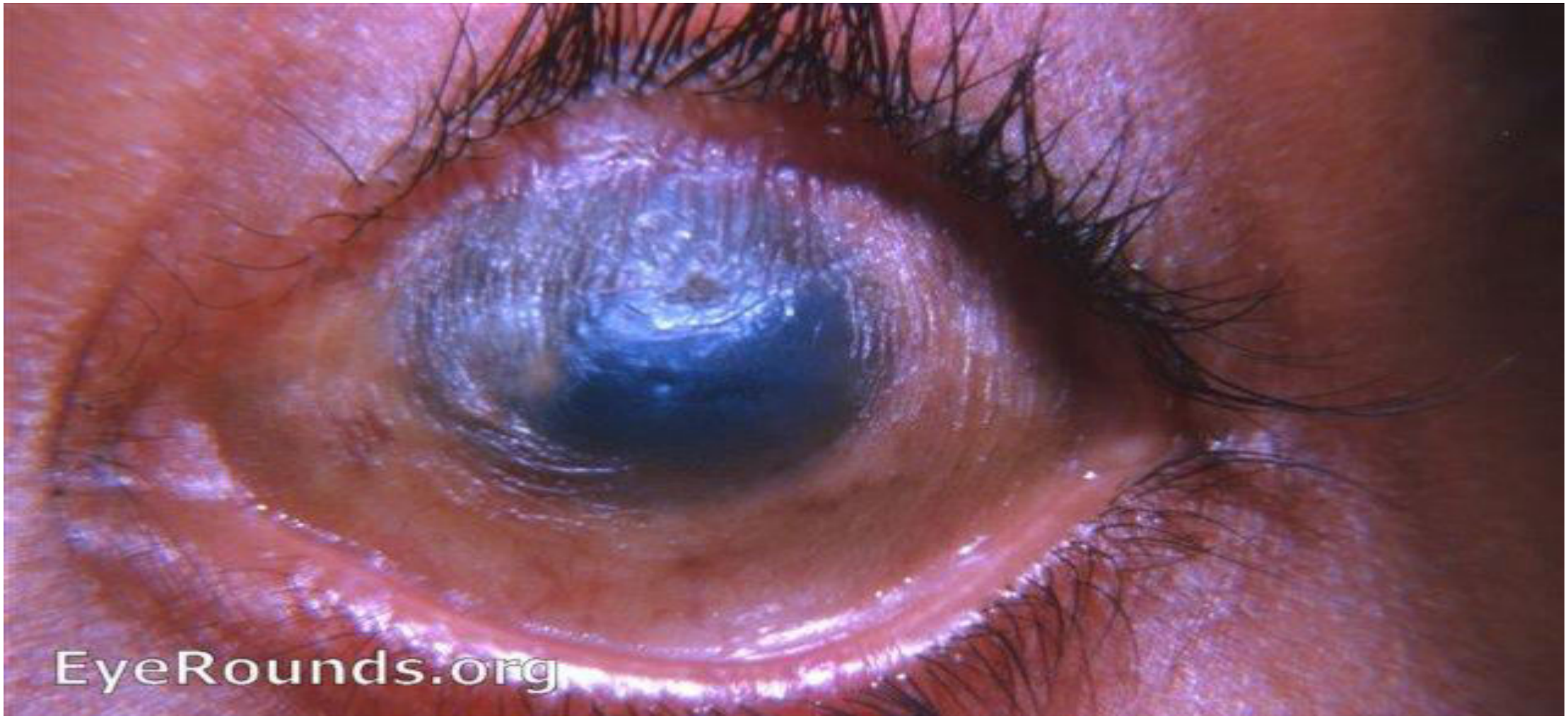
Clinical features

- Night blindess is the earliest symptom
- Dryness & Ocular foreign body sensation
- It appears as soft yellowish subconjunctival mass near the outer canthus with lusterless appearance(bitot’s spot)
- The surface is keratinized & may exhibit hair,

Grading system WHO

Grade of xerophthalmia	Peak age group (years)	Type of deficiency
XN: Night blindness	2-6; adult women	Longstanding. Not blinding
X1A: Conjunctival xerosis	3-6	Longstanding. Not blinding
X1B: Bitot's spots	3-6	Longstanding. Not blinding
X2: Corneal xerosis	1-4	Acute deficiency. Can be blinding
X3A: Corneal ulcer <1/3 cornea	1-4	Severe acute deficiency. Blinding
X3B: Corneal ulcer/keratomalacia1/3 cornea or greater	1-4	Severe acute deficiency. Blinding
XS: Corneal scarring (from X3)	>2	Consequence of corneal ulceration
XF: Xerophthalmos fundus	Adults	Longstanding. Not blinding. Rare


EyeRounds.org


EyeRounds.org

Different stages

- 5-year-old boy with severe autism and an extremely poor diet (only bacon, an occasional blueberry muffin, and Kool Aid) presented with bilateral corneal ulceration.
- **Figure 1** Exam revealed generalized hyperkeratosis and lash hypertrichosis,
- **Figure 2** Bilateral diffuse Rose Bengal staining with Bitots spots at the superior limbus of the left eye,
- **Figure 3** shows numerous yellow flecks in the peripheral retina at the level of the retinal pigment epithelium
- **Figure 4** A conjunctival biopsy showed keratinized conjunctival epithelium
- ***Figure 5*** days later, he developed a corneal descemetocele in the right eye despite intensive antibiotic drop therapy.
- He was managed with a penetrating keratoplasty and tarsorrhaphy as well as punctal occlusion.
- Vitamin A palmitate, 100,000 USP units, was given intramuscularly. A further 50,000 USP units was given 2 months later. 3 months post-operatively, the corneal graft was clear and the ocular surface appeared normal.[16] Images courtesy of Thomas L. Steinemann, MD.

Figure 1

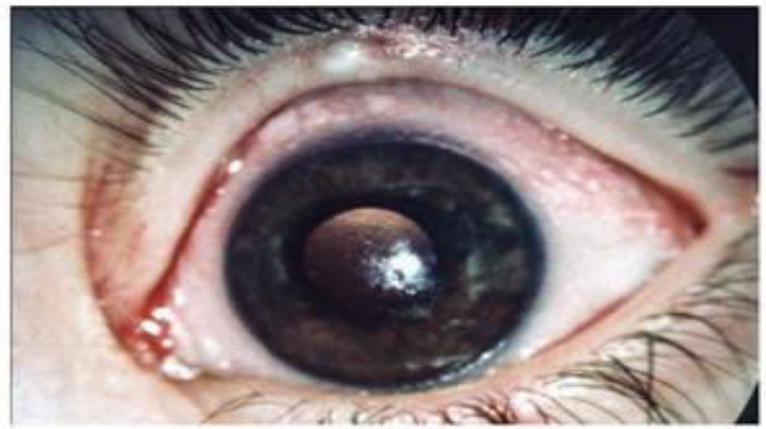


Figure 2

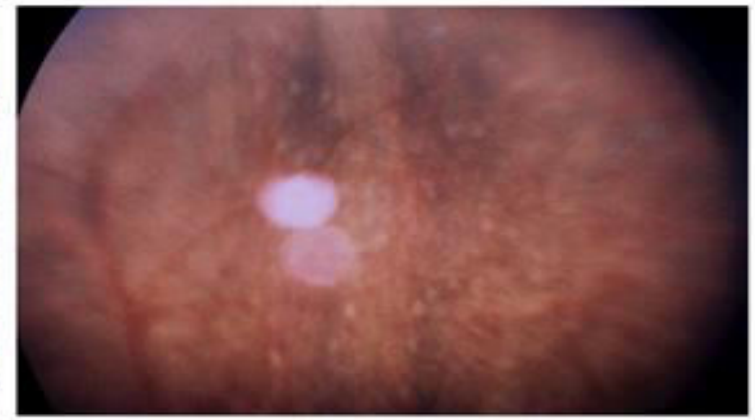


Figure 3

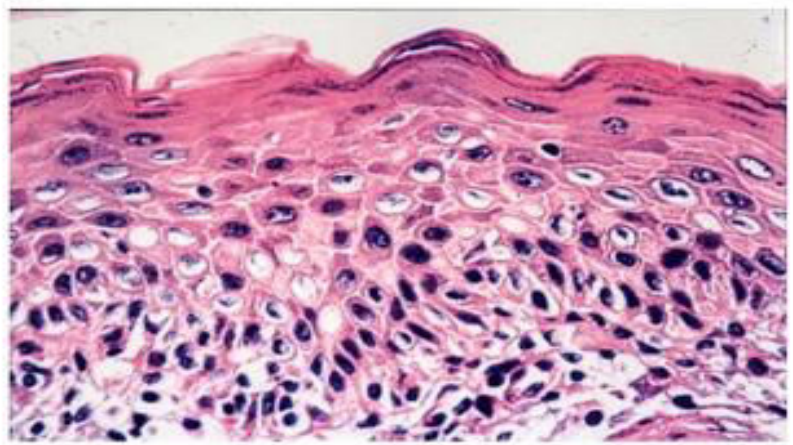


Figure 4

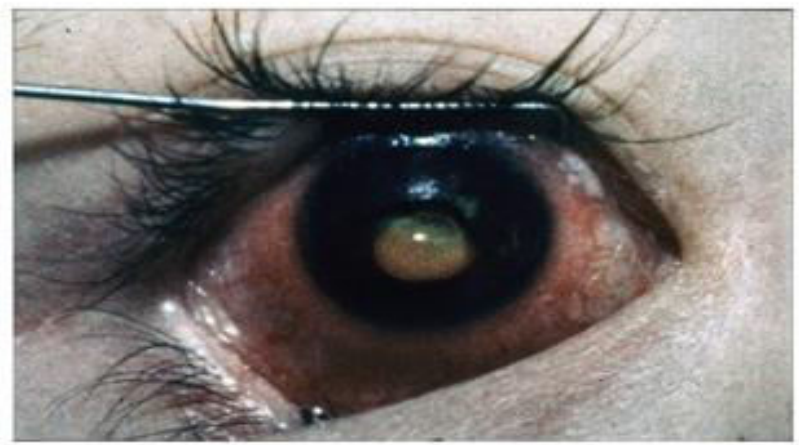


Figure 5

Management

- Keratomalacia should be treated as a medical emergency, as it is an indicator of very severe VAD. High-dose vitamin A is the treatment for all patients, and treatment can either be oral or intramuscular. Recommended Vitamin A deficiency treatment regimens are described in the following table[13]. Treatment can be adjusted as needed based on regular serum retinol level monitoring

Management

Vitamin A dosage (IU)	
Young infants 0-5 mo[1]	50,000
Older infants 6-11 mo[1]	100,000
Children (males: 12 mo or more;females 12 mo to 12 y and 50 y or more)[1]	200,000
Women (13-49 y) withnight blindness and/or Bitot's spots	10,000 every day or 25,000 every week for at least 3 mo
Women (13-49 y) with activecorneal lesions	200,000 on days 1, 2, and 14

Schedule of Vitamin A doses

- Sever malnutrition, Day 1
- Measles , Day 1& Day 2
- Xerophthalmia, day1 day 2 day 14

- Serum vitamin A/retinol normal range: 20-60 mcg/dL. These levels can be normal due to maintenance of circulating retinol levels by hepatic stores.
- VAD-related ocular symptoms have been shown to develop at concentrations <10mcg/dL.
- Serum retinol binding protein (reference range: 30-75 ug/ml).
- Serum zinc (reference range: 75-120 mcg/dL)
-