

## Dr S K Rao: Session On Ocular Surface Staining- Highlights

### Relevant Corneal anatomy

Normal Cornea stains negative because

- cells are healthy
- cells are flat
- have tight junctions which preclude entry of dye
- Microvilli absorb membrane associated mucus that form glycocalyx

Deeper to this are gap junctions through which solution can diffuse more easily making corneal epithelium semipermeable to solution with very low molecular weight.

In Disease/Damaged Cornea- stain is taken up due to

- cell death
- loss of tight junction
- glycocalyx is lost

Free floating mucin will stain +ve

Once stain penetrates deeper it spreads easily due to porous gap junctions

### Dr Braun recognised phenomenon of transient stippling in a normal cornea:-

A) Transient staining in normal cornea-(variable location) may be due to normal epithelial turnover which is an orderly process of programmed cell death (apoptosis)

- senescent cell send signal to underlying cell
- then underlying cell takes over the function
- during this time before take over, there may be transient pooling
- sometimes if the underlying cell is not ready there may be staining as glycocalyx is still immature. In a matter of time, this stops staining (glycocalyx matures)

B) In cases of Cell death due to damage or disease

- Cell death happens suddenly
- The underlying cell is unprepared to take up the function
- Therefore, tight junctions are not yet re-established
- Fluorescein can enter & has access to all adjacent gap junctions
- Thus, larger areas stained in case of cell death due to damage/disease as compared to physiological apoptosis

### Solution associated corneal staining (preservative associated transient hyperfluorescence)

- Refers to stippled corneal staining in peripheral cornea seen in contact lens users who soak their contact lenses in multipurpose solutions containing cationic biguanide as preservative.
- Corneal epithelium is able to take up the cationic biguanide (high content found 2 hours post application of the lens)

- If stained at this point, the anionic fluorescein is taken up by the same and is seen as stippled stain
- Over time there is gradual diffusion of the biguanide out of the epithelium rendering such staining both transient and non-toxic

### Vital Dyes

Applicant/Concentration	Fluorescein	Rose Bengal	Lissamine green
Strip	0.6-2mg	1.3mg	1-1.5mg
Solution	2%	1%	1%

### Quenching phenomenon (BegleyC et al 2019/71/208)

Seen in fluorescein stain

- Low concentration - very little fluorescence
- Mid concentration - more fluorescence
- More concentration - drop in fluorescence (tightly packed fluorescein molecules tend to absorb the fluorescence leading to quenching)

Upto 0.01% - no fluorescence//More than 0.25% - absorption//0.1 to 0.2% - ideal fluorescence

Clinical relevance: Use minimal dye at first staining, gives opportunity to restain later if required without quenching

**Use 1uL of 2%Fluorescein in 10 uL tears = 0.2%**

### Significance of staining

#### Cornea

- Inferior 1/3 of cornea- lid margin disease
- Upper 1/3 - upper lid related (allergic)- flip lid to reveal cause
- Interpalpebral 1/3- dryness
- Interpalpebral +superior cornea -preservative/medication toxicity

#### Conjunctiva

- Superior bulbar- SLKC
- Inferior- conjunctivochalasis
- Nasal -ocp related ulceration, canaliculitis
- Temporal -Moraxella angular conjunctivitis
- Upper lid -Lid wiper epitheliopathy
- Line of Marx - migrates posteriorly in dry eye
- Conjunctival inflammation and staining below line joining two canthi- medicamentosa
- Corneal staining exceeds conjunctival staining in medicamentosa (not so in dry eye )
- Extensive symptoms+minimal stain implies inflammation

## ***Dr SKR order of Testing: FBUT-Cornea-LG-Conjunctiva-Schirmer-Meibomian gland assessment***

### **Topical anaesthetic for F stain**

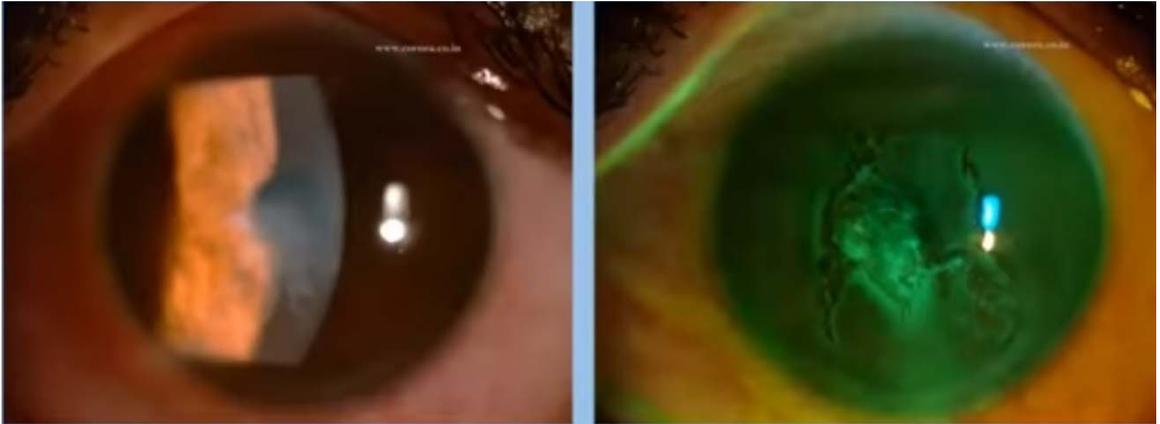
- Paracaine as any other topical anaesthetic causes loosening of tight junctions, therefore best avoided as diluent
- Fluorescein+ Benoxinate HCl available in West and useful for applanation/gonioscopy/corneal foreign body removal. Not yet available in India

### **General tips**

- Best timing to study surface is before doing any other ophthalmic exam
- It is a good practice to train anyone who does the first staining to document the findings (on paper or photograph) before the peak effect wears off (10 minutes)
- Important not to stain an ulcer before initial assessment
- Use max illumination for assessment of F and reduce illumination for RB (green filter) LG (Red filter)

## Images

### 1. Recurrent corneal erosion

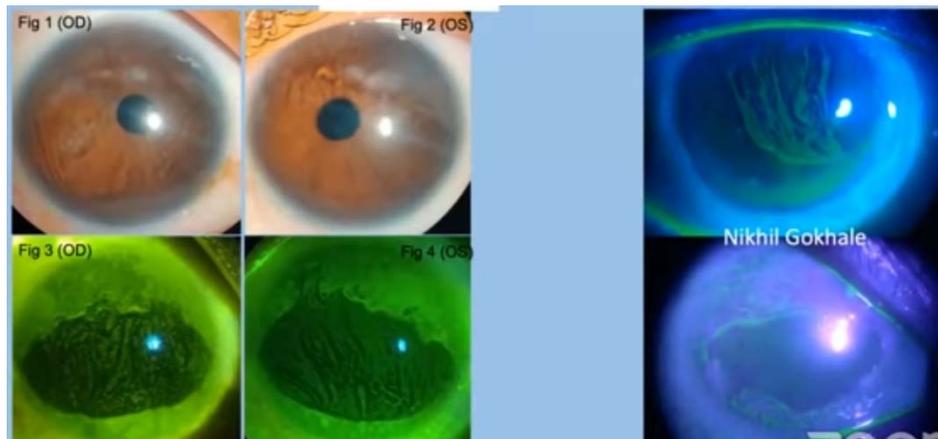


- Stain helps to know the boundary of loose epithelium
- Use atraumatic/fine tip forceps to remove loose epithelium, pull towards the centre, repeat till you reach firmly adherent epithelium
- document area of loose epithelium for any planned interventions (stromal puncture/PTK)
  - retro illumination reveals microcysts in recently healed cases
  - suspect subtle secondary infection in extremely symptomatic patients
- alcohol delamination gives good results, allows easy peeling

### PTK in RCE

- Aim is basement membrane polishing
- depth ideal is 7.5u (practically 10u) after epithelial removal
- Area of ablation varies from case to case
- Laser platform vary in optical zone allowance (visx doesn't allow more than 6.5mm,) in which case we need to decentre the beam or use rock and roll technique
- Peripheral trauma induced erosion- de-link the pupil centration device and manually centre beam on area of interest if off pupillary axis
- Anterior basement membrane issues- large zone ptk is a good idea
- If RCE zone partly abuts the pupil can use large zone of ablation covering entire pupil
- If pattern is possible use the same
- If BM complex is damaged, RCE may recur even after ptk
- repeat PTK can cause scarring

## 2. Limbal stem cell deficiency



- conjunctival epithelium on cornea has stippled appearance
- Whorling pattern was described in Dr Dua's paper
- Surviving corneal Islands may exist due to persistent (presumed) transient amplifying cells in the cornea
- Good light reflex indicates absence of concomitant dry eye disease

## 3. Superior Limbic Keratoconjunctivitis



Thickened inflamed boggy superior bulbar-conjunctiva

Associated with thyroid eye disease

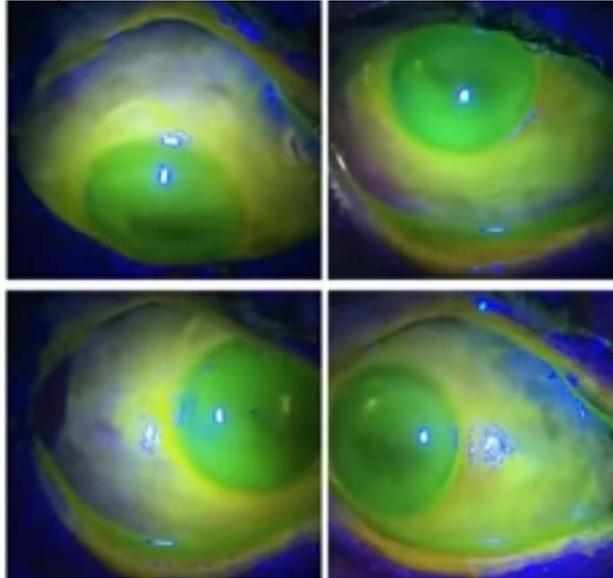
SLKC and lid wiper epitheliopathy are likely a single spectrum

In SLKC, friction related trauma not related to lid margin:

Glazed epithelium, Superior microcorneal erosions, Microfilaments

Lid wiper epitheliopathy: Lid margin (wiper) stains positive

#### 4. Acute chemical injury



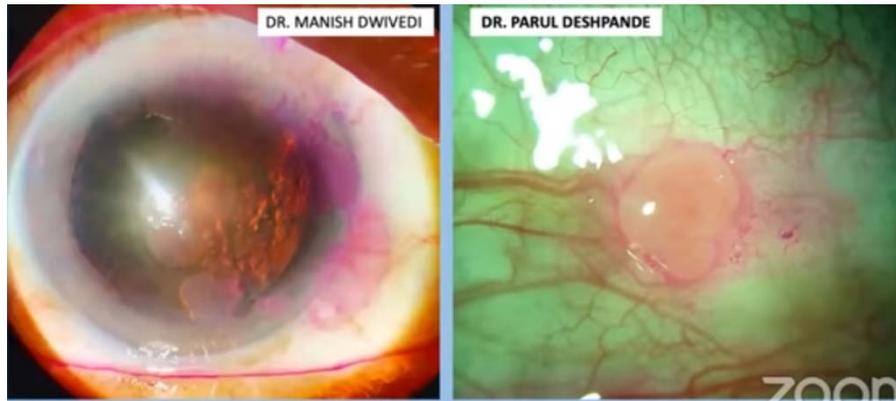
- Observe entire ocular surface(after lid eversion)to know extent of damage
- Make sure to use sufficient amount of fluorescein
- Stain only after complete evaluation
- Monitor stain positive areas at each visit
- If planning AMT, stain positive area will help in sizing
- For documentation, take external photo using smart phone after staining

#### 5. SJS



- Staining helps in identification of early lid margin keratinisation(LMK) and accurate grading
- Negative staining of LMK correspond with positive staining on the cornea
- Staining helps in monitoring post MMG response

## 6. Ocular surface tumors



- Rose Bengal stain delineate extent of lesion and helps in planning the surgery
- Documentation based on slit lamp findings should be done and that drawing should be taken to operating room to decide the extent of tumor
- Alternative dyes: toluidine blue/ methylene blue are taken up by actively replicating cells. These may be useful as a good screening dyes but have high false positive rate. At present, their clinical application is limited.

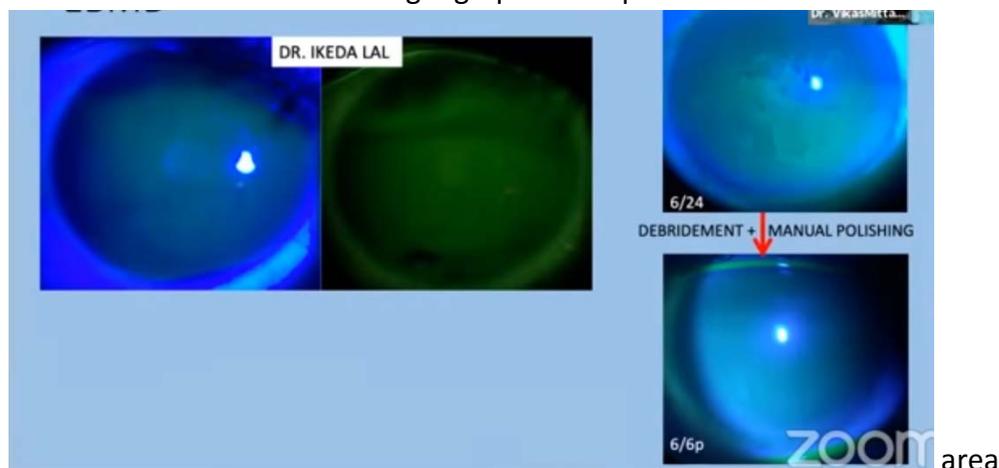
## 7. Drug toxicity



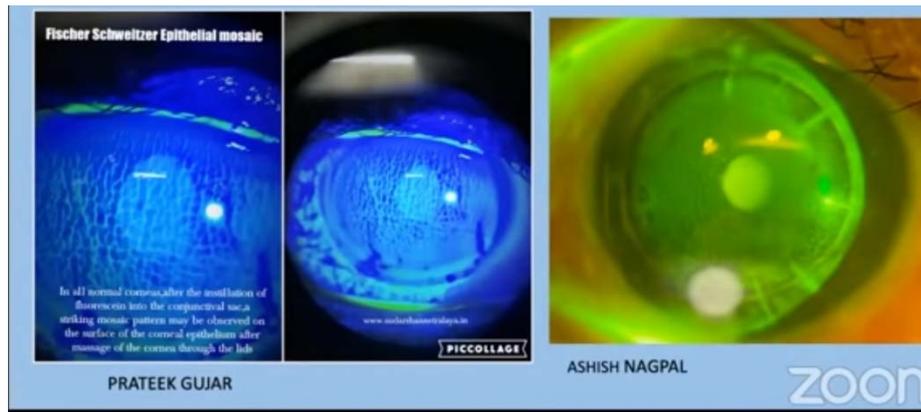
Lower half of conjunctiva has more staining compared to upper half

## 8. EBMD

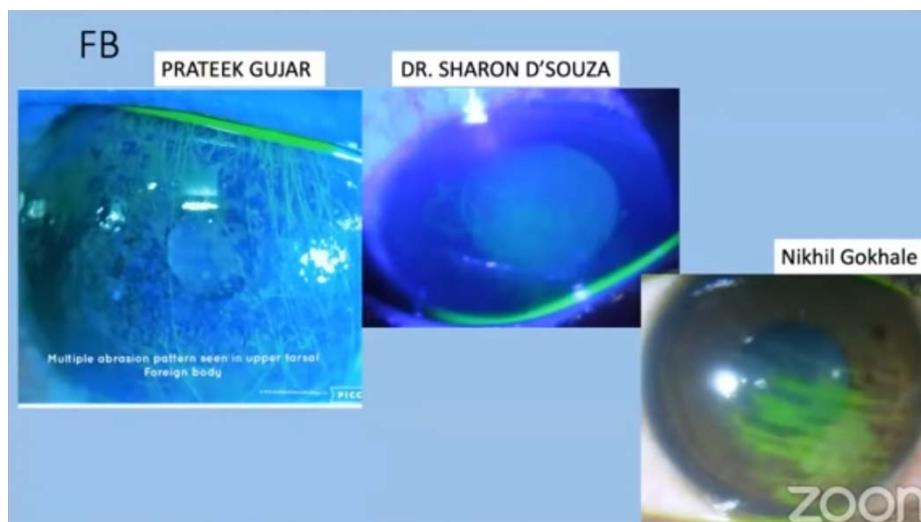
Raised geographical map like



## 9. Epithelial mosaic: honeycomb like pattern



## 10. Pattern abrasion



- Often pattern abrasions are associated with foreign body under the lids
- Horizontal abrasions are usually seen if patients have tried to remove the FB themselves

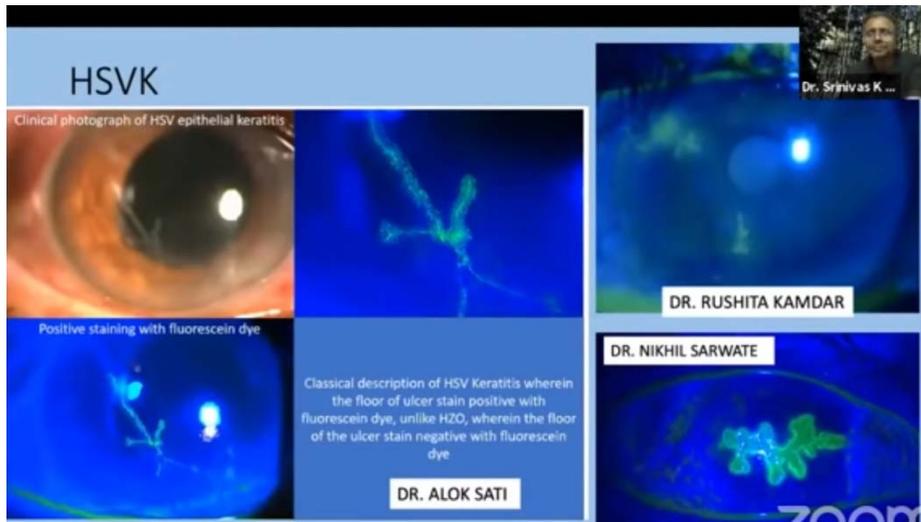
## 11. Methemoglobinemia



Irregular corneal surface

Need to show pediatrician and haematologist

## 12. Dendrites



Rule out immunosuppression in case of multifocal dendrites

## 13. Healing epithelial defect

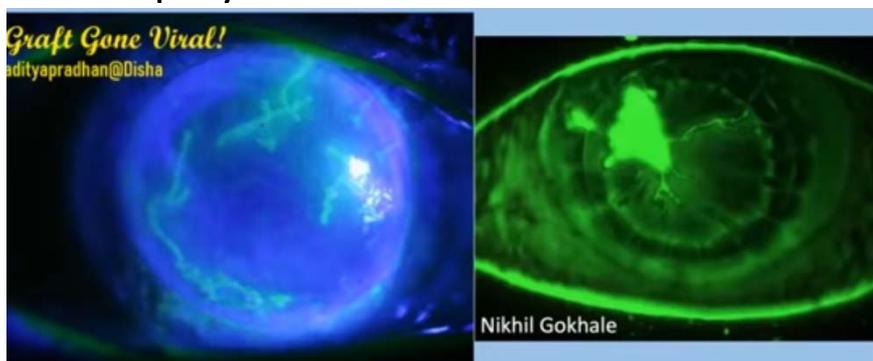
May appear as a pseudodendrites

Surrounding cornea is unhealthy with stippled staining whereas surrounding cornea is clear in HSV associated dendrite.

## 14. Vortex keratopathy

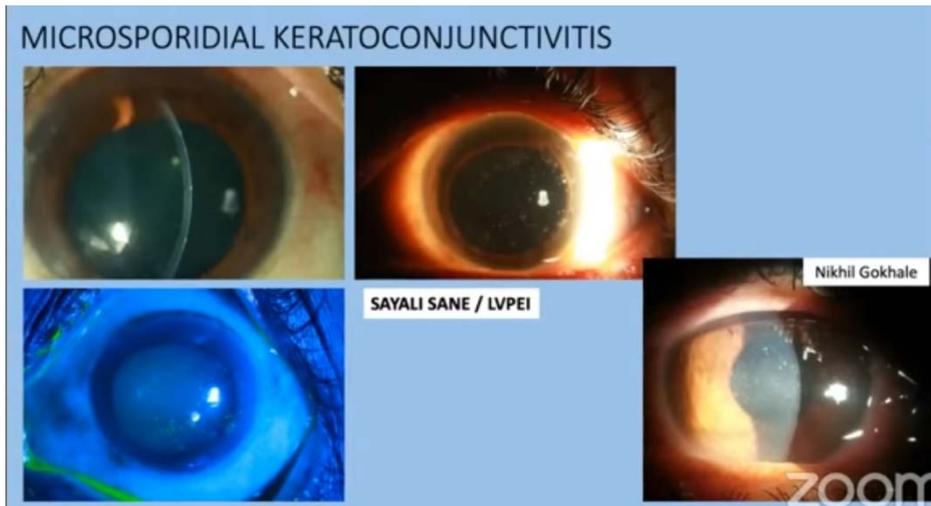
Associated with various drug use

## 15. Post keratoplasty HSV keratitis



Often straddle graft host junction

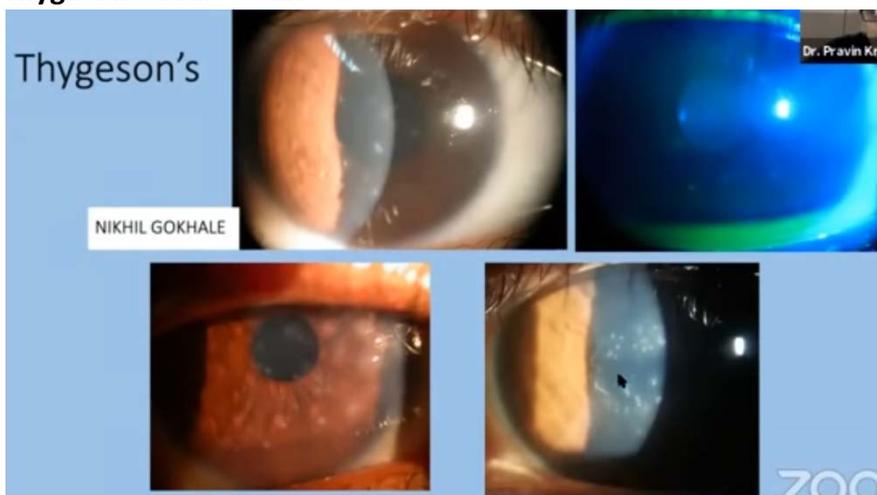
## 16. Microsporidiosis



Raised multiple white lesion

Stuck on appearance

## 17. Thygeson's coarse PEK



Raised epithelial keratitis

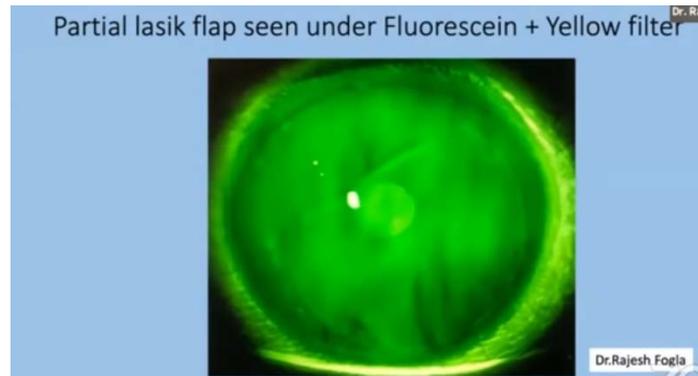
## 18. Dry eye



Stippled pattern

May show filaments

## 19. Lasik flap architecture



### **VIDEO:**

- By cutting the circular black piece of commercially available yellow filter and sticking it on the objective lens, it can work as a convenient adaptor to put and remove yellow filter.
- Yellow filter tends to scratch easily and is recommended to be stored in a cushioned case

