

DRY EYE & Carboxymethyl Cellulose

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SHANTI EYE CARE CENTRE

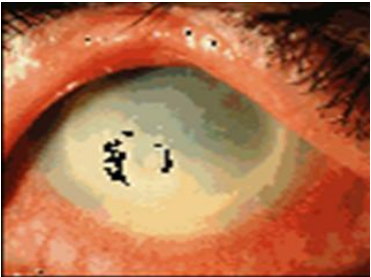


Dinner session sponsored by Cipla Foresight, held on 19-03-05 at Hotel Satya Ashoka. Session followed by Dinner.

Dry eye disease is a chronic inflammatory condition of the eye in which the precorneal film gets altered in function due to the dysfunction of tear volume or tear quality alone or both leading to a complex symptomatology.

Dry eye may be sight-threatening

Bacterial Keratitis



Corneal Ulcer

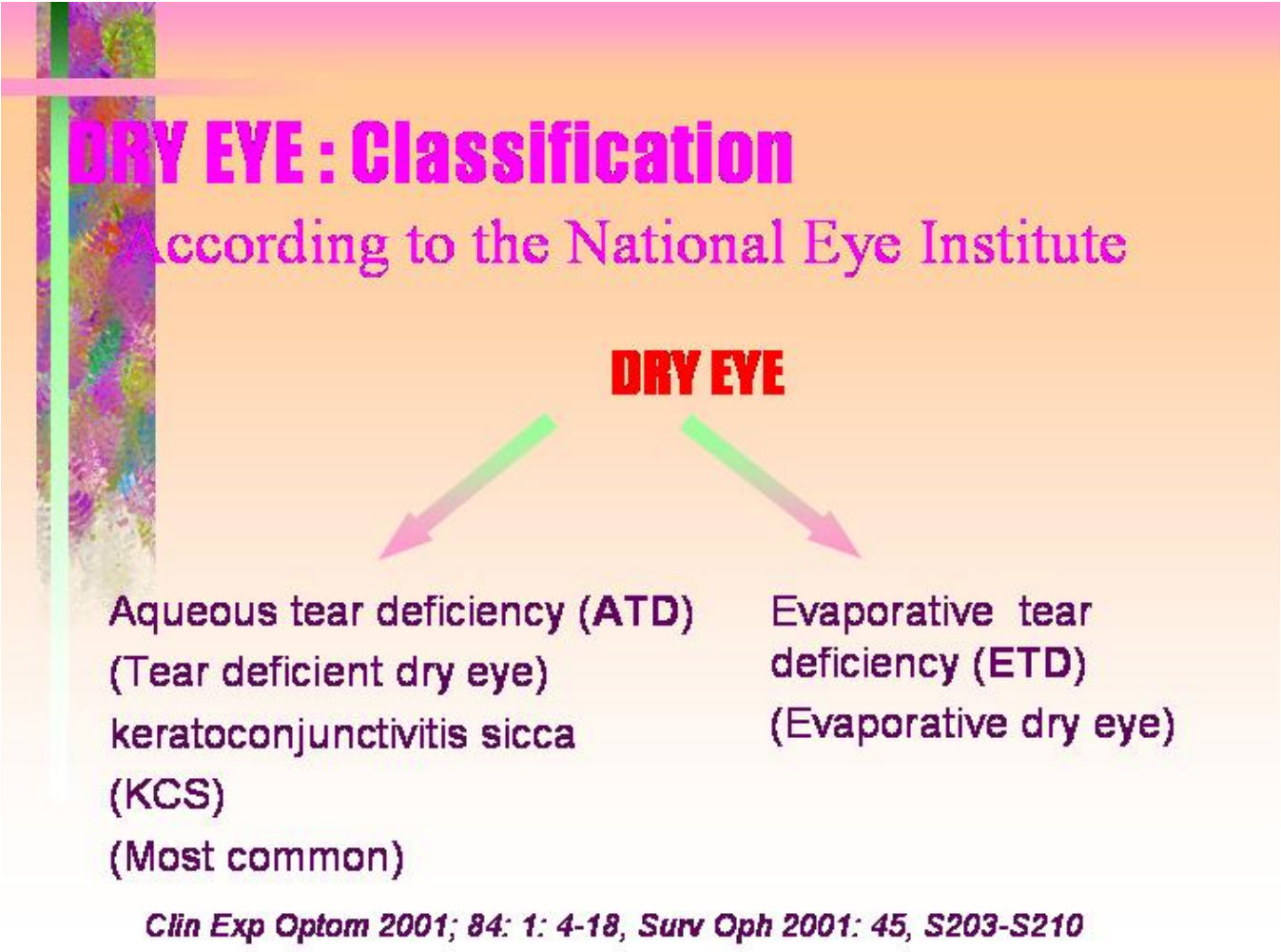


Prevalence of dry eye increases significantly with age and is more common in women.

Classification -- Murube &Rivas classification(2003)

- Grade-0 = Normal
- Grade-1 = Occasional Symptoms No Signs
- Grade-2 = More Often Sympoms No Signs
- Grade-3 = Symptoms Present In Daily Life And Signs Also Present
- Grade-4 = Symptoms Present Always. Signs Present
- Grade-5 = Symptoms And Signs In Form Of Scarring, Vascularization Of Cornea

DRY EYE : Classification



Dry Eye: Main Causes

Tear deficient dry eye **Keratoconjunctivitis sicca** (KCS)

Sjogrens: Autoimmune disorder with a triad of dry mouth, dry eye and arthritis

Non-Sjogrens

Ageing - Gradual deterioration of lacrimal gland tissue occurs with ageing

Menopause - At the time of menopause, levels of androgens drop down

Neurotrophic keratitis - Corneal sensitivity decreases after LASIK, PRK, contact lens wear and diabetes

Medicamentosa - Anti histamines, anti-depressants, beta blockers

Cicatricial Diseases - Trachoma, chemical burns, Stevens Johnson syndrome

(Ref: Clin. Exp. Optom 2001; 84: 1:4-18; J. Am. Optom Assoc. 1991; 62: 187-199;

Suppl P and T Digest 2003; 28(2): 1-45)

EVAPORATIVE DRY DISEASE

Meibomian gland disease: Most prevalent (65%). Obstruction of meibomian gland

Lid surfacing anomalies: Lid closure affected, blinking affected

Ocular surface toxicity: Long term use of topical antiglaucoma medications, preservatives like BAK

Contact lens related

Allergy

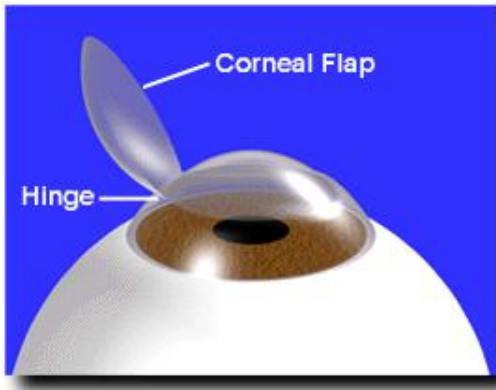
LASIK induced dry eye

Creation of partial corneal flap

Certain amount of nerve damage occurs

Decreased corneal sensation

Reduction of tears



Contact Lens Wear

20-30% of contact lens wearers have dry eye symptoms.

The presence of contact lens,hard or soft,represents a stress to the tear film and can lead to contact lens - induced dry eye.

Decreased corneal sensation

Reduced reflex tearing

Increased evaporation

(abs of replacement of disrupted tear film)

Hypertonic tear film

(increased osmolarity, i.e increase in solutes)

Hypertonic tear film indicating dry eye causes symptoms of discomfort during lens wear.

Extensions of interblink period due to intense concentration due to close work and computer work concentration leads to drying of ocular surface.

Normal blink rate : 15 times/min

Working on computer: 5 times/min

Chronic Allergy

Dry eye is commonly associated with chronic allergic conjunctivitis.

An allergic history has been reported by 36% of dry eye patients.

Chronic allergy results in loss of goblet cells, destabilization of the tear film & damage to ocular surface.

VKC is associated with 38% incidence of dry eye.

Symptoms

Irritation

Redness

Burning/ Stinging

Itchy eyes

Sandy- gritty feeling (foreign body sensation)

Blurred vision

Tearing

Contact lens intolerance.

Increased frequency of blinking

Mucous discharge.

Photophobia (less frequent symptom)

Symptoms worsen in windy or air-conditioned environments.

As day progresses.

After prolonged reading, working on computers

Cinical signs

Chronic papillary conjunctivitis

Chronic meibomitis - toothpaste sign

Blepharitis

Debris in tear film

Presence of lipcof (lid parallel conjuctival fold)

Interpalpebral hyperemia

Tear marginal meniscus < 0.3 mm

Meibomian gland health:

Gland orifice metaplasia

Meibomian gland expression test

trans illumination of inferior tarsus

Meibomian Gland Expression Test:

Grade-0 Expression Of Five Glands

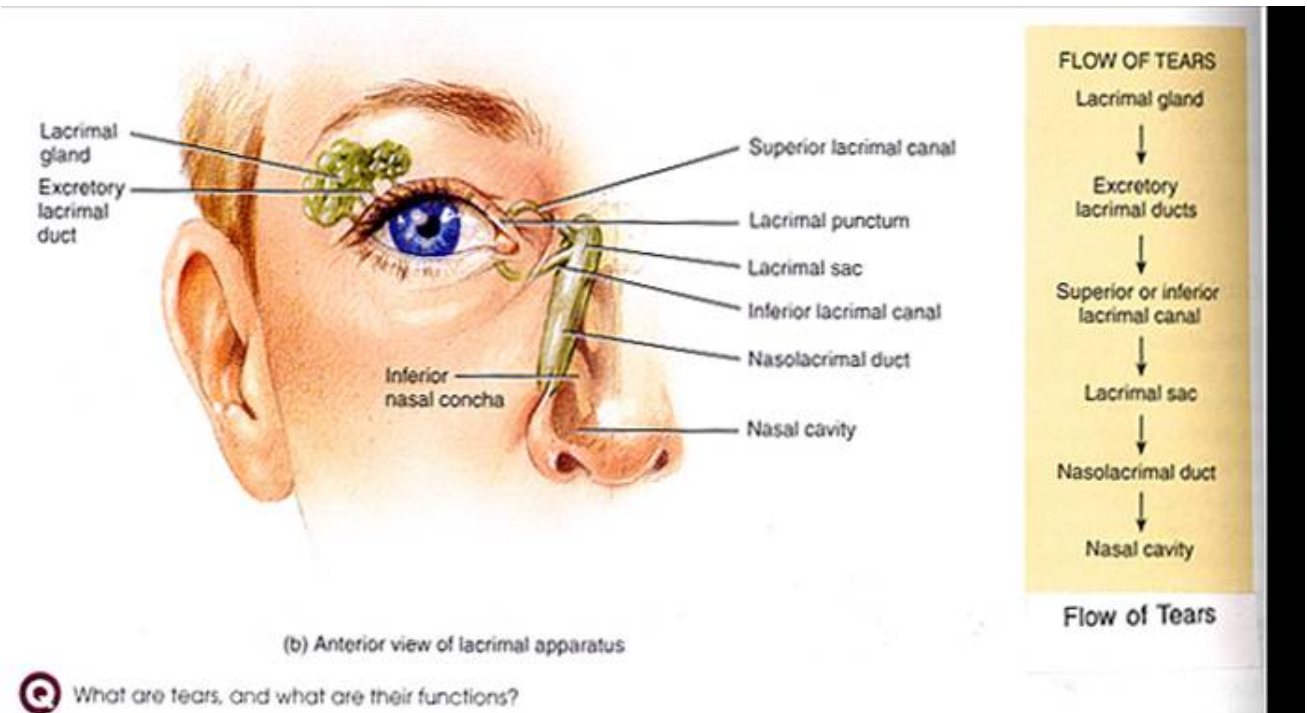
Grade-1 Four Glands Expressed

Grade-2 Three Glands Expressed
Grade-3 Two Glands Expressed
Grade-4: No Glands Expressed

Pathophysiology

Tears are a complex solution composed of water, enzymes, proteins, immunoglobulins, lipids, various metabolites, exfoliated epithelial and polymorphonuclear cells

Lacrimal apparatus

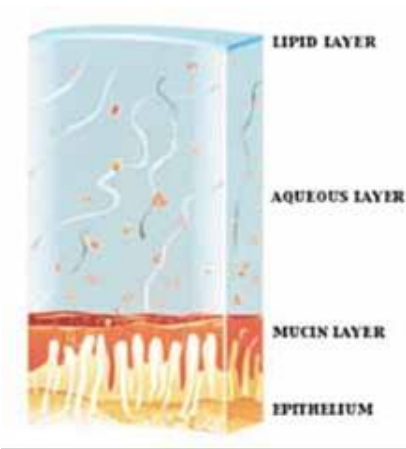


- Tears: Functions
- Lubricate the ocular surface.
 - Nourish the ocular surface
 - Forms a smooth, even layer over ocular surface
 - Provides antibacterial system for ocular surface
 - Serves as a vehicle for the entry of PMNs in case of injury
 - Dilutes and washes away toxic irritants

Production and turnover of tears is essential to maintain health of the ocular surface

- Tears: Physical Properties
- Rate of secretion 1.2 ml/min (Basal)
 - Turnover rate - 12-16 %/min
 - Osmolarity - 310-334 mOsm/k
 - pH 7.5 + 0.16

Tear Film: Anatomy & Physiology



Trilaminar structure

- Consists of :
- Thin anterior lipid layer (0.1 mm)
 - Intermediate aqueous layer (7 mm)
 - Innermost mucous layer (0.02-0.04 mm)

Lipid Layer

- Oily covering composed of waxy and cholesterol esters
- Secreted predominantly by the meibomian glands
- Function: Inhibit evaporation of underlying aqueous layer

Aqueous Layer

- Sandwiched between lipid and mucin layer
- Comprises vast majority of tear film thickness
- Secreted by the lacrimal glands

Function

- Lubricate cornea and conjunctiva
- Cleanses by flushing debris from ocular surface
- Important for immunity and nutrition of ocular surface

Mucin Layer

- Innermost component of tear film
- Secreted by the goblet cells of conjunctiva

Function

- To help aqueous layer adhere to corneal surface
- Help proper spreading of tear film

DIAGNOSTIC TESTS

- Schirmer's test I
- Schirmer's test II
- Rose bengal 'staining /lissamine green staining
- Fluorescein stain test

SCHIRMER'S TEST I

- If Wetting <3mm=V.Severe Dry Eye
- If Wetting 3-5 mm=Severe Dry Eye

If Wetting 5-10mm= Moderate Dry Eye
If Wetting is 10mm= Mild Dry Eye
If Wetting >10mm= Normal Eye



SCHIRMER'S TEST II

If Wetting<10mm -- >irratate the nasal mucosa with cotton bud ,note add. wetting
If no Wetting or <1mm-->Sjogren's syndrome
If Wetting increases by 1mm --> Non - Sjogren's syndrome

Rose Bengal staining

Rose Bengal solution 1% placed into the conjunctival sac.

After a wait of 2 mins, degree of rose bengal staining on bulbar conjunctiva and cornea is quantitated by microscopic exam.

Stains devitalized cells.

Also stains mucous strands (very often present in KCS)

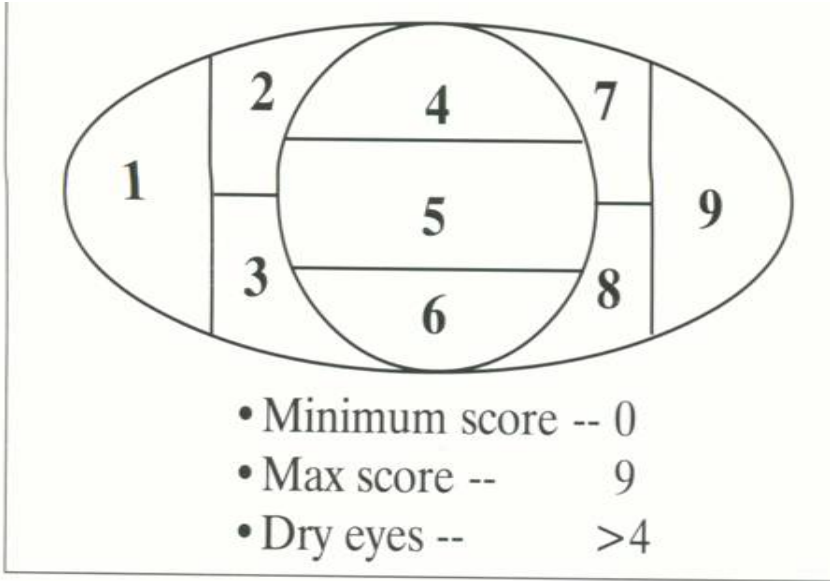


Fig 5 - Schematic drawing of the ocular surface showing division of the ocular surface into 3 zones to assess rose bengal staining.

FLUORESCEIN STAIN TEST

-->No staining=Grade -0
-->1/3 =Grade-1
-->2/3 =Grade-2
-->3/3 =Grade-3

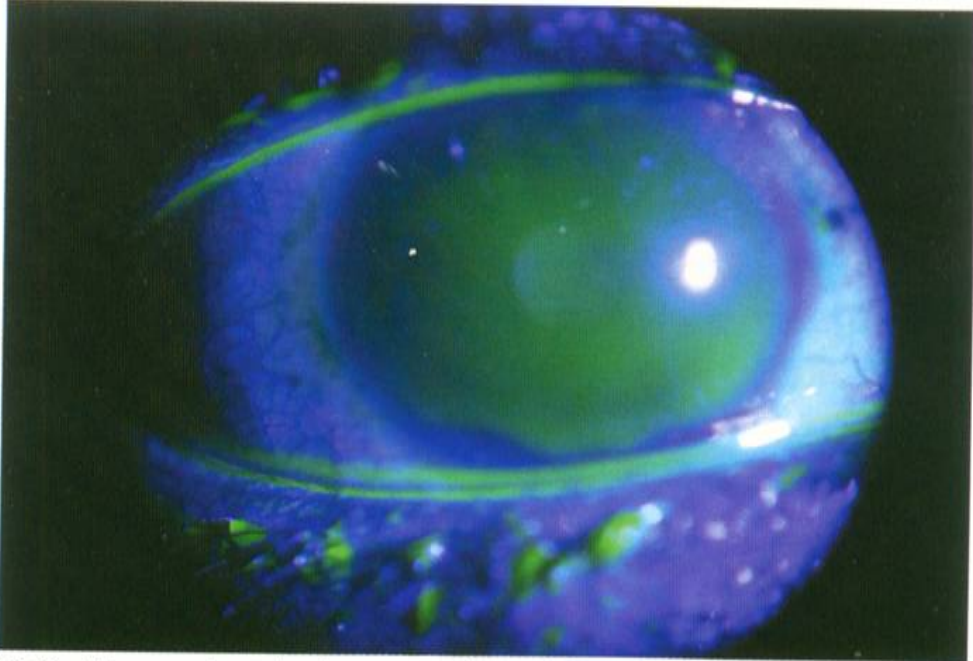


Fig 2 - Fluorescein stained precorneal tear film as viewed through the cobalt blue filter of the slit-lamp.

TFBUT:

Normal >10sec
Grade 4 < 3sec

Slit lamp fluorophotometry:

-->GRADE-0= No superficial punctum corneal stain
-->GRADE-1=No severe SPK at center of cornea
-->GRADE-2= Mild SPK at center of cornea
-->GRADE-3= Severe SPK at center of cornea

OCULAR PROTECTIVE INDEX(OPI):

OPI<1= Patient at risk OPI>1= Not at risk

TEAR OSMOLARITY:

Normal=302Mos+_6.3/litre
Dry Eye=>350Mos/litre

CLOSED CHAMBER INFRARED THERMOMETRY:

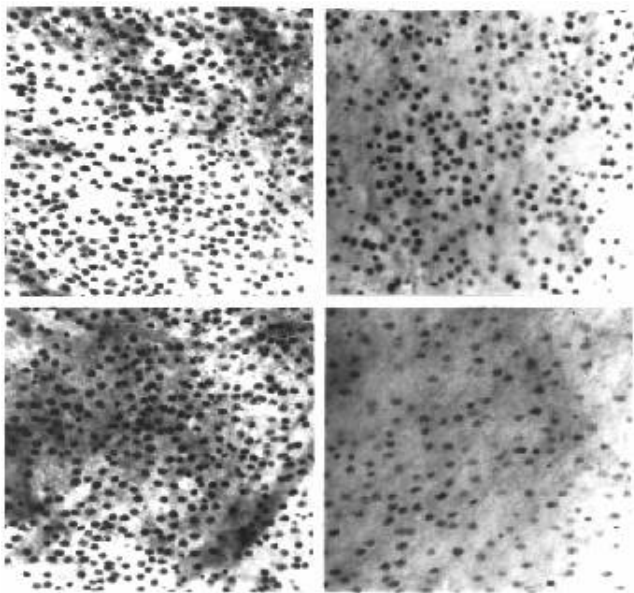
Normal: TEMP INCREASED by 0.1 degree Celcius after opening the eye
Dry Eye: NO INCREASE IN TEMP. after opening the eye

CLOSED CHAMBER HUMIDITY OF THE EYE:

Normal = < 1RH%
Dry eye = > 1RH% (1RH% TO 4RH%)
Features--> Most reliable,Quick , Non -invasive for dry eye

LAB DIAGNOSIS

IMPRESSION CYTOLOGY



CA 19-9 ELISA TEST
OCULAR FERNING TEST:
No Ferning:
Pemphigus
Stevenson Johnson syndrome
Non Dry Eye : Ferning is present in 91%

Dry Eye: Management

MEDICAL THERAPY
SUPPORTIVE THERAPY
THERAPY OF THE UNDERLYING CAUSE
SURGICAL THERAPY
TREATMENT OF DRY EYE IS NOT "ONE SIZE FITS ALL"

MEDICAL THERAPY

TEAR SUBSTITUTES

Tear substitutes:benefits
Tear substitutes are the mainstay of therapy for dry eye.
Provide adequate relief
Increase humidity at the ocular surface and improve lubrication.
Smooth the ocular surface leading to improved vision.
Intra/post-operative use has shown to help restore ocular surface after refractive surgery.
Improve patients' quality of life.

What should an ideal tear substitute contain?

Polymer (ocular lubricant)
Electrolytes
Preservative

Polymers in tear substitutes

Carboxymethylcellulose (CMC)
Hydroxypropylmethylcellulose (HPMC)
Polyvinyl Alcohol (PVA)

Carboxymethylcellulose 0.5% : Highlights

Carboxymethylcellulose provides better protection, lubrication and clinical efficacy compared to other polymers.
Improves the health of conjunctival and corneal cells in patients with KCS.
Plays a role in the reversal of squamous metaplasia in patients with KCS.
Superior to HPMC in alleviating symptoms of KCS.

Provides immediate relief and lasting protection against dryness and irritation.
Appropriate to use when conventional tear substitutes are inadequate.
Comfortable upon instillation.
Safe to use as often as needed.
Appropriate to use for post-LASIK ocular dryness.

Electrolytes

Electrolytes in " artificial tears" mimic human tears and renew dry eyes.

Provide an environment for the ocular surface conducive to re-establishment of normal corneal epithelial barrier.

Electrolytes are crucial in maintaining conjunctival goblet cells.

Preservative

CHEMICAL-BAK, Chlorbutol, Phenyl Mercuric Nitrite, etc

OXIDATIVE-Stabilized Oxy-chloro-complex, Sodium Perborate

NON-TOXIC TO EPITHELIUM

Dry eye patients:Adverse Effects of preserved medications

More susceptible to toxic effects of topical medications.

Inhibited tear clearance resulting in prolonged residence time of preservatives (potential toxins) on the ocular surface.

Prolonged exposure to preservatives leads to inflammation which leads to chronic irritation and can worsen dry eye

Hence artificial tears must be free of toxic preservatives , particularly if dosing at greater than 4-6 times/ day.

How about a preservative that keeps the eye drops preserved in the bottle but preservative free in the eye?

Preservative-free solutions thus established a new benchmark in artificial tear solution treatment.

SOC converts to natural components of tears in the eye

Sodium & Chloride ions

Stabilized oxychloro

Complex

oxygen + water

SLOW RELEASE ARTIFICAL TEAR DEVICES (LACRISERTS)

Advantage: Longer duration of action

LUBRICATING OINTMENT

Non -medicated ,semi -solid preparation, white petrolatum, liquid lanolin and mineral oil

Used only at bed -time

Retained longer than solution

Local immunosuppressive agents

Cycloporin:0.05%to0.1% two times a day

Autologous Serum

Long term treatment with sodium hyaluronate

Castor oil eye drops for non -inflammatory obstructive gland dysfunction

Supracutaneous administration of calcium ointment 10%

Carbomer gel 0.3%

Androgens in dry eye

Secretogogues

Pilocarpine

SUPPORTIVE THERAPY

Use of eye shields, glasses with side shields or swimmers goggles

Contact Lens

Vaporizer or humidifier

SURGICAL THERAPY

Subcutaneous abdominal artificial tear pump- Reservoir for severe dry eyes

Preservation of tears by occluding with punctal plugs

Silicone punctal plugs

Increase the contact lens wear

Reduces dependency on tear drops

Permanent intracanalicular silicone plug

Occlusion of the punctum or with LASER or diathermy

Autologous Limbal Transplantation

Soluble Collagen Discs

Amniotic Membrane transplantation

Auto conjunctiva (Punch patch technique)

Rectal mucosa

Lips mucosa

Frontal sinus drainage

Parotid duct transplantation

Tarsorrhaphy in dry eye

Treating dry eye symptoms Is important for short-term comfort and the long-term health of your cornea.