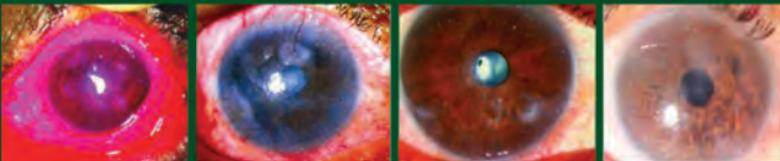
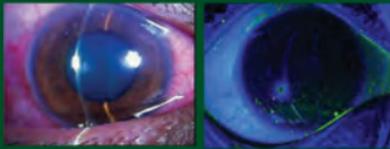




# Dry Eye Disease



***This CME Material has been supported by the funds of the AIOS, but the views expressed therein do not reflect the official opinion of the AIOS.***

As part of the AIOS CME Programme  
Published July 2013

*Published by:*

**ALL INDIA OPHTHALMOLOGICAL SOCIETY**

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# Dry Eye Disease



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## Foreword

**Dry Eye Disease** is one of the most frequently diagnosed condition & Tear substitutes are most often prescribed (abused) drops by Ophthalmologists.

When we do not understand Patient's symptoms & Eye examination seems within normal limits – all of us prescribe lubricating drops.

If Patient is still unhappy after few days/weeks – he/she is given another set of lubricating drops often more Expensive one – this – by the same doctor or even by another eye doctor or even by Optometrist/Optician. Patient sometimes self medicates and complicates the issue.

Often Pharma companies are more happy than the patient.

This booklet by Dr. Basak – an authority in Cornea, explains everything you want to know about '**Dry Eye Disease**' &

Hopefully after reading this excellent monogram, we all will become wiser in our approach to **DED**.



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## Preface

Dry eye Disease one of the most frequently encountered clinical diagnosis in any ophthalmic practice. The Management is often not in the lines of severity of the disease.

If we follow systematic evaluation and grading, Dry eye disease is one condition that can be practiced at all levels of ophthalmic care. Only cases of severe grades of dry eye and those with associated systematic disease, needs expert opinion as well as evaluation by other fraternities like Rheumatology.

The preferred practice patterns on dry eye disease is first of its kind to give a global perspective pertinent to Indian Scenario in terms of management of dry eye disease.

I would like to thank Dr Samar Kumar Basak for his efforts and Dr Virender S Sangwan & Namrata Sharma, for their expert comments on the subject.

Hope every reader appreciate the quality of work and efforts of the contributors.



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## About the Preferred Practice Pattern on Dry eye Disease

Dry eye disease (DED), either alone or in combination with other conditions, is a frequent cause of ocular irritation that leads the patients to seek ophthalmic care. Due to a wide variety of presenting symptoms, it is often unrecognized and this causes great frustration of the patient and treating physician. While these symptoms often improve with appropriate treatment, usually in majority of the cases the disease may not be curable. In many cases, dry eye disease can be a cause of significant visual morbidity and may compromise the results of cataract, corneal and refractive surgery.

There are great advances in the understanding of dry eye disease over the past 10-15 years in the area of epidemiology, pathogenesis, clinical manifestation, and possibly in the therapeutic regimen. In the process of making this Preferred Practice Pattern (PPP) document, a systematic literature review was made using PubMed databases till September 2011. These are on the articles published in the peer-review journals on different aspect on dry eye diseases, such as, epidemiology, inflammatory aspect, tears substitutes, surgical options, newer treatment options, etc. The author also has taken guidance from the report of the “International Dry Eye Workshop (DEWS) 2007”.<sup>1</sup>

Any ophthalmologist is a physician at first. We strive to communicate effectively with our dry eye patients, listening carefully to their needs and concerns. It is our duty to educate our patients about the nature, natural history and prognosis of their DED condition and about appropriate therapeutic modalities available. This is important to ensure about their active participation in decisions affecting their management, to improve their motivation and compliance with the agreed therapeutic plan, and also to help alleviate their fears and concerns about the disease. Continuous

counselling in every visit is an important key factor to boost up the psychological status of the patients.

The author like to acknowledge the “Preferred practice pattern on Dry eye” published by American Academy of Ophthalmology in 2008 which gives a good idea how to go on making PPP on DED in Indian context.<sup>2</sup> The author express his sincere thanks to the Chairman, Academic Research Committee and to the Governing Council, All India Ophthalmological Society for giving this opportunity of writing on preferred practice pattern (PPP) on dry eye disease. We wish all ophthalmologists for good reading and a comprehensive referencing.

1. 2007 Report of the International Dry eye Workshop (DEWS). (Special issue) *Ocul Surf.* 2007;5:65-199.
2. American Academy of Ophthalmology Panel. Preferred Practice Pattern® Guidelines. Dry Eye Syndrome. San Francisco, CA: American Academy of Ophthalmology; 2008. Available at: <http://www.aao.org/ppp>.

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# Introduction

## Consensus on dry eye diseases

- ♦ *Prior to 1995: No formal consensus on the definition, diagnosis or treatment of dry eye syndrome.*
- ♦ *In 1995: National Eye Institute/industry workshop: Consensus developed on definition, diagnosis and treatment.<sup>1</sup>*
- ♦ *During 2004-2006: International Task Force – DELPHI consensus panel on Dysfunctional tear syndrome: first recommended the level approach of treatment of the dry eye diseases.<sup>2</sup>*
- ♦ *In 2007: International Dry Eye Workshop (DEWS): more scientific knowledge and understanding.<sup>3</sup>*
- ♦ *In 2011: International Workshop on Meibomian Gland Dysfunction:*
- ♦ *More wide area coverage on MGD.<sup>4</sup>*

## Dry Eye Disease: Definition

**NEI definition (1995):** Dry eye disease (DED) is a disorder of the tear film due to reduced tear production or excessive tear evaporation, which causes damage to the inter-palpebral ocular surface and is associated with symptoms of ocular discomfort and/or visual symptoms.<sup>1</sup>

**DEWS Definition (2007):** Dry eye disease is a multifactorial disease of the tear film and ocular surface that results in symptoms of discomfort, visual disturbance, and tears film instability with potential damage to the ocular surface. It is accompanied by increased osmolality of tear film and inflammation of the ocular surface.<sup>5</sup>

**Dry eye disease in India:** There is no population-based study in relation to dry eye disease in India. However, there are only three published reports on prevalence of dry eye among hospital-based population from North and Eastern India and the prevalence varies between 18.4% and 40.8%.<sup>6-9</sup> One small study from high altitude showed a higher prevalence of 54%.<sup>10</sup>

**Purpose of approach to dry eye patients:** To detect the dry eye diseases early so as to improve the patient's comfort and to prevent or minimize further structural damage to the ocular surface.

### **Goals of this topic**

- To establish the diagnosis of dry eye and to differentiate it from other causes of irritation
- To identify the causes of dry eye
- To establish appropriate therapy and to give relief from discomfort
- To prevent complications, such as loss of visual function, infection, and structural damage
- To educate and involve the patient in the management of this disease

**Patient Population** includes individuals of all ages who present with symptoms and signs suggestive of dry eye diseases, such as irritation, redness, grittiness, fluctuating vision, and decreased tear meniscus.

**Target audience:** Primary eye care physician/optometrists, resident/ fellow ophthalmologists, comprehensive ophthalmologists, ophthalmic private practitioners and all sub speciality ophthalmologists.

## **Demography**

### **Epidemiology**

- ♦ There is no doubt that in recent years, dry eye disease is an extremely common condition that causes varying degrees of ocular discomfort and disability.
- ♦ Information on DED is limited due lack of uniformity in its definition and the inability of any single diagnostic test or set of diagnostic tests to confirm or rule out the condition. Thus, there has been a shift towards symptom-based assessment as the key component of clinical diagnosis.<sup>11-15</sup>

- ♦ Reported prevalence of dry eye in the literature is diverse: ranging between 7.8% in one study from western world<sup>16</sup> and 93.2% in one study from Asia.<sup>17</sup>
- ♦ This is probably because of two factors: first, the geographical location of the study population and secondly, there is no standardization of the selected population, dry eye questionnaires, objective tests and dry eye diagnostic criteria.<sup>3,13</sup>
- ♦ It is also widely agreed that Meibomian gland dysfunction (MGD) is the most common cause of evaporative dry eye disease.<sup>18,19</sup> Recent studies showed that the prevalence of Meibomian gland dysfunction (MGD) in general population varies between 30.5% and 54.1%.<sup>20,21</sup>
- ♦ Asian studies on DED showed that the prevalence of dry eye is higher than that in western population and it is between 14.5% and 93.2%.<sup>13,15,16,7-9,22-29</sup> Table IA and Table IB separately compare the prevalence of dry eye in Western world and Asian countries. There are only three studies from India available in the peer-review journals and two of them from the North and one from Eastern India. With different diagnostic criteria the prevalence of dry eye in these studies was Between 18.4 and 40.8%.<sup>7-9</sup> One small study from Leh showed a higher prevalence of dry eye of 54% in high altitude.<sup>10</sup>

## **Etiological risk factors in DED**

Many etiological factors for dry eye have been proposed (Table 2).

- ♦ Older age and female gender have been identified as risk factors for dry eye.<sup>12,15,30</sup>
- ♦ Arthritis was found to be associated with an increased risk of dry eye in two studies.<sup>12,15</sup>
- ♦ Smoking and multivitamin use were associated with an increased risk of dry eye, whereas caffeine use was associated with a decreased risk.<sup>12</sup>
- ♦ Hormone replacement therapy, and especially when estrogen is used alone, was associated with an increased risk of clinically diagnosed dry eye syndrome or severe symptoms.<sup>31</sup>

## Associated factors and conditions

- ♦ Symptoms may be exacerbated by systemic medications – such as antihistamines, beta-blockers, anticholinergics, antidepressants, diuretics and systemic retinoids (isotretinoin).<sup>12,32-34</sup>
- ♦ Frequent Instillation (e.g., more than four times a day) of preservatives containing eye drops, for more than 6 weeks.
- ♦ Environmental factors, such as reduced humidity and increased wind, drafts, air conditioning, or heating may exacerbate the ocular discomfort.
- ♦ Exogenous irritants and allergens, although not believed to be causative of dry eye, may exacerbate the symptoms.
- ♦ Blepharitis associated with meibomianitis was noted between 3.6% and 54.1% of the subjects aged 50 years and older in different studies.<sup>34-36</sup> Those patients were twice as likely to have dry eye symptoms as those without signs of meibomianitis.<sup>35</sup>
- ♦ *Associated systemic diseases:* such as Sjögren syndrome, in which an inflammatory cellular infiltration of the lacrimal gland leads to aqueous tear-production deficiency, and rosacea, which is associated with posterior blepharitis or meibomianitis with increased tear evaporation.
- ♦ Aqueous tear deficiency dry eye may develop in conditions that result in infiltration of the lacrimal gland and replacement of the secretory acini such as lymphoma, sarcoidosis,<sup>38,39</sup> hemochromatosis, and amyloidosis.<sup>40</sup>
- ♦ Dry eye may develop in patients with systemic viral infections. It has been reported in patients infected by the retroviruses, human T-cell lymphotropic virus (HTLV) type I, and human immunodeficiency virus (HIV).<sup>41</sup> Dry eye was diagnosed in 21% of a group of patients with AIDS<sup>42</sup> and a condition known as diffuse infiltrative lymphadenopathy syndrome has been reported in patients with HIV infection, most of whom were children.<sup>41</sup>
- ♦ Decreased tear secretion, reduced tear volume, and reduced tear concentrations of lactoferrin have been reported in patients with hepatitis C.<sup>43,44</sup> Lacrimal gland swelling, Dry eye disease, and Sjögren syndrome have been associated with primary and persistent Epstein- Barr virus infections.<sup>45-48</sup>

**Table: 1A Prevalence of dry eye in different population-based studies in Western World**

Authors	Name of the study	Site of study	Age (Year)	Sample size	Diagnostic criteria	Prevalence rate (%)
Caffery, 1994	Canadian Dry Eye Epidemiology Study (CANDEES)	Canada	All ages	13517	One or more symptoms: often or all the time	28.7
Schein, 1997	Salisbury Eye Evaluation Study (SEE)	America	65-84	2420	6-item questionnaire: one or more present - often or all the time Abnormal Schirmer's test Abnormal rose Bengal test	14.6 2.2 2.0
McCarty, 1998	Melbourne Visual Impairment Project (MVIP)	Australia	40-97	926	Abnormal rose Bengal test Abnormal Schirmer's test Low Tear-film break up time Fluorescein staining Two or more signs Severe dry eye symptoms	10.8 16.3 8.6 1.5 7.4 5.5
Moss, 2000	Beaver Dam Eye Study (BDES)	America	48-91	3722	Self -reported history of dry eye	14.4
Chia, 2003	Blue Mountains Eye Study (BMES)	Australia	50-90	1075	Three or more symptoms regardless of severity. At least one symptom with moderate to severe intensity	15.3 16.6
Schaumburg, 2003	Women's Health Study (WHS)	America	≥ 49	36995	Severe symptoms of both dryness and irritation either constantly or often	7.8
Viso, 2011	Salnes Eye Study	Spain	40-96	654	One or more present - often or all the time Meibomian gland dysfunction	11 30.5

**Table: IB Prevalence of dry eye in different population-based studies in Asian countries**

Authors	Name of the study	Site of study	Age (Year)	Sample size	Diagnostic criteria	Prevalence rate (%)
Schimmura, 1999		Japanese	20-49		Self-diagnostic criteria (dry eye symptoms in last 3 months)	33
Jamaliah, 2002		Malaysia	≥	200	One or more symptoms plus one abnormal sign (Tear film break up time or Phenol red thread)	14.5
Lee, 2002	Riau Eye Study	Indonesia	>21	1058	6-item questionnaire: one or more often or all the time	27.5
Lin, 2003	Shihpai Eye Study	Taiwan	≥65	1361	One or more symptoms: often or all the time Meibomian gland dysfunction	33.7 38.8
Lekhanont, 2006		Bangkok, Thailand	>40	550	One or more symptoms: often or all the time; Tear film break up time Schirmer's test Meibomian gland dysfunction	34 54.7 50 46.2
Jie, 2009	Beijing Eye Study	China	>40	1957	One or more symptoms: often or all the time;	21
Bukhari, 2009		Saudi Arabia	Any age	251	One or more symptoms: often or all the time; Blepharitis	93.2 91.9
Han, 2011		Korea	≥65	657	6-item questionnaire: ≥ 1 symptoms; often or all the time	30.3
Sahai, 2005		Jaipur, India	>20	500	Symptoms plus any one of abnormal Schirmer's, Tear film break up time or filaments	18.4
Gupta, 2008		Leh, India	>20	50	McMonnies' and OSDI questionnaires	54
Gupta, 2010		Delhi, India	>40	400	McMonnies' and OSDI questionnaires	29.3
Basak, 2012		West Bengal	>30	3023	6-item questionnaires: ≥ 1 symptoms; often or all the time Symptoms and one positive sign Meibomian gland dysfunction	40.8% 26.1% 31.7%

- ♦ Severe dry eye has been reported to occur in recipients of allogenic bone marrow or stem cell transplants who develop graft-versus-host disease (GVHD).<sup>49</sup> In chronic GVHD, there is infiltration and fibrosis of the lacrimal glands as a result of T-cell infiltration with fibroblasts.<sup>50-51</sup>
- ♦ Diseases such as ocular cicatricial mucous membrane pemphigoid (OCP) and Stevens-Johnson syndrome (SJS) produce tear deficiency due to inflammation, scarring, and destruction of the conjunctival goblet cells. Atopy and chronic allergic conjunctivitis may produce dry eye due to blepharitis, conjunctival scarring, or long-term antihistamine use.
- ♦ *Local conditions associated with dry eye:* such as eyelid malposition, lagophthalmos, and blepharitis as well as neuromuscular disorders that affect blinking (e.g., Parkinson disease, Bell's palsy).<sup>52</sup>
- ♦ *Local ocular surface trauma:* such as orbital surgery, radiation, and injury chemical or thermal, may also cause dry eye.

## Pathogenesis

- ♦ It is now recognized that the lacrimal glands, ocular surface (cornea, conjunctiva and meibomian glands), lids, and the sensory and motor nerves that connect them – act as an integrated functional unit (Lacrimal functional unit or LFU) to maintain the tear production and to clear used tears.<sup>53</sup>
- ♦ Disease or any dysfunction of this unit results in an unstable and poorly maintained tear film that causes ocular irritation and epithelial disease called keratoconjunctivitis sicca (KCS).
- ♦ Dysfunction of this integrated LFU – may develop from natural aging, a decrease in supportive factors (e.g., androgen hormones), systemic inflammatory diseases (e.g., rheumatoid arthritis), ocular surface diseases (e.g., HSV keratitis) or surgeries that disrupt the trigeminal afferent sensory nerves (e.g., LASIK), and systemic diseases or medications that disrupt the efferent cholinergic nerves that stimulate tear secretion.<sup>54</sup>

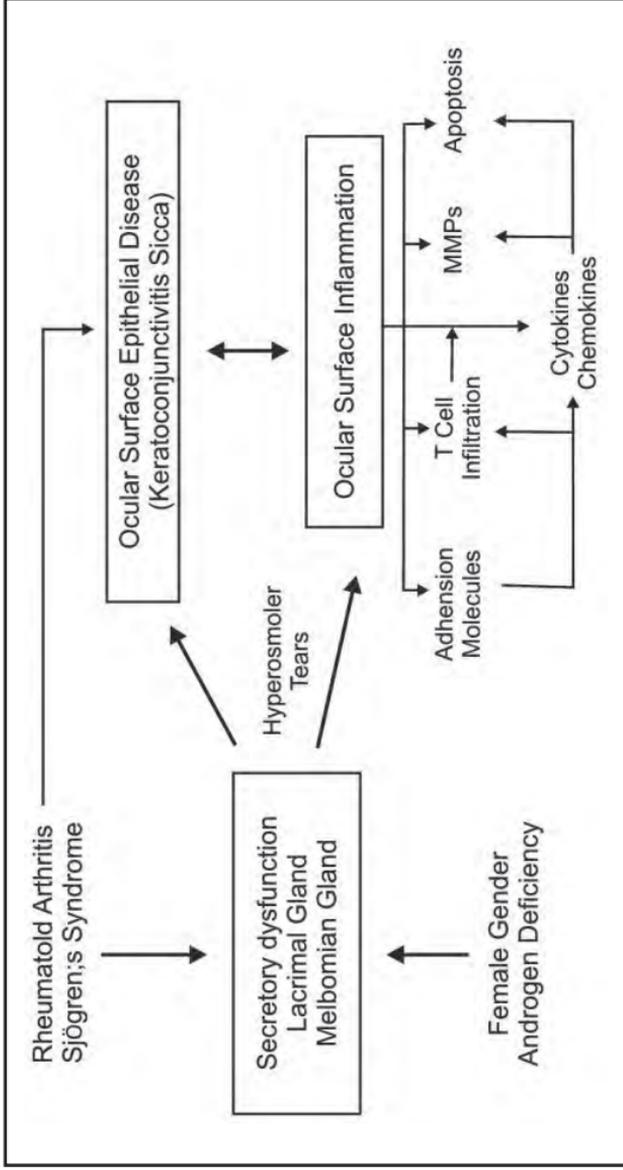


Figure 1 : Inflammatory Mechanisms in Keratoconjunctivitis sicca

MMP = Matrix metalloproteinases

Source: Pflugfelder SC. Anti-inflammatory theory for dry eye. *Am J Ophthalmol* 2004; 137: 338.

- ♦ Decreased tear secretion and clearance initiates an inflammatory response on the ocular surface that involves both soluble and cellular proinflammatory mediators (cytokines).<sup>55,56</sup>
- ♦ Clinical and basic research suggests that this inflammation plays a role in the pathogenesis of KCS mediated by T-cell lymphocytes (Figure 1).<sup>57,58</sup> This finding has also been supported by the studies investigating the role of anti-inflammatory therapies.

## Natural History

- ♦ Dry eye syndrome varies in severity, duration, and with etiology.<sup>1</sup>
- ♦ In majority cases, the condition is not sight-threatening and is characterized by irritation and intermittently blurring of vision.
- ♦ In some individuals, exacerbating factors such as systemic medications or environmental conditions may lead to an acute increase in the severity of symptoms.
- ♦ Elimination of such factors often leads to marked improvement and may even be curative.
- ♦ In other patients like in Sjogren's syndrome or in blepharitis where the disease may exhibit chronicity - characterized by fluctuating severity of symptoms and/or a gradual increase in symptom severity with time.
- ♦ Reversible conjunctival squamous metaplasia and punctate epithelial erosions of the cornea develop in many patients who have moderate to severe dry eye.
- ♦ Rarely, patients with severe dry eye develop sight-threatening complications - such as ocular surface keratinization; corneal dellen, thinning, scarring, vascularization; microbial or sterile corneal ulceration with possible perforation; and severe visual loss.<sup>59</sup>

## Diagnosis

Many ocular surface diseases produce symptoms that are similar to those associated with dry eye, including foreign body sensation, mild itching, irritation, and soreness.

Identifying characteristics of the causative factors, such as adverse environments (e.g., air travel, sitting near an air conditioner vent, low humidity), prolonged visual efforts (e.g., reading, watching TV or computer use), or ameliorating circumstances (symptomatic relief with the use of artificial tears) is helpful in diagnosing dry eye.

Supporting clinical observations and tests are used to confirm the diagnosis.

**A diagnostic classification scheme adapted from the 2007 Report of the International Dry Eye Workshop is shown in Figure 2.**

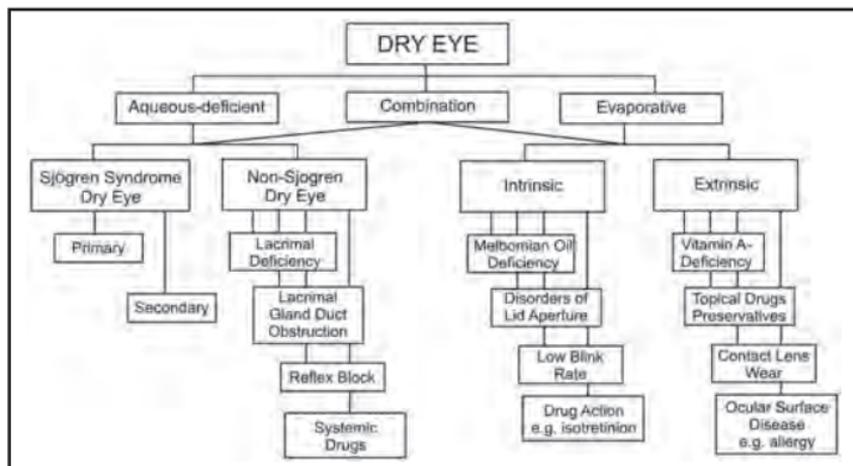


Figure 2: Major etiological factors for dry eye disease

Source: Lemp MA (chair). Definition and classification of dry eye disease: report of the definition and classification subcommittee of the International Dry Eye Work Shop (DEWS - 2007). *Ocul Surf* 2007; 5: 77.

- ♦ Participants in the workshop agreed that the two major factors, deficient aqueous tear production and increased evaporative loss, may cause dry eyes independently, but they may also be present together and both significantly contribute to dry eye symptoms and signs.
- ♦ Most patients have multiple factors contributing to dry eye. Many conditions, such as neurotropic keratitis after herpes simplex virus infection or LASIK, induce both decreased tear production and increased evaporative loss.
- ♦ All patients should have a comprehensive eye evaluation at the recommended intervals.

## Patient History

### Symptoms:

- ♦ **Presenting complaints:** Irritation, tearing, burning, stinging, dry or foreign body sensation, mild itching, photophobia, blurry vision, contact lens intolerance, redness, mucous discharge, increased frequency of blinking, diurnal fluctuation, and symptoms that worsen later in the day.
- ♦ Duration of symptoms.
- ♦ **Exacerbating conditions:** e.g., wind, air travel, decreased humidity, prolonged visual efforts associated with decreased blink rate such as reading or watching TV.

### Ocular history details about the following:

- Topical medications used, their frequency, and their effect on symptoms: e.g., frequent “eyewash”, artificial tears, anti-histaminic, glaucoma medications, vasoconstrictors, corticosteroids
- Contact lens wear: type of CL, wearing schedule, and care
- Allergic blepharo-conjunctivitis or other type of chronic allergic eye disease
- *Ocular surgical history:* e.g., prior keratoplasty, cataract surgery and its type, keratorefractive surgery
- *Ocular surface disease:* e.g., herpes simplex virus, varicella zoster virus, OCP, SJS, aniridia, GVHD

- *Punctal occlusion*: temporary or permanent
- *Eyelid surgery*: e.g., e.g., prior ptosis repair, blepharoplasty, entropion/ectropion repair
- Bell's palsy

### **Medical history details:**

- Menopause
- *Systemic inflammatory diseases*: e.g., Sjögren syndrome, GVHD, rheumatoid arthritis, systemic lupus erythematosus, scleroderma
- *Oral cavity*: Dry mouth, dental cavities, oral ulcers
- *Dermatological diseases*: e.g., rosacea, vesiculo-bullous lesions
- *Atopy*: e.g., dermatitis, rhinitis, bronchial asthma
- *Systemic medications*: e.g., antihistamines, diuretics, hormones and hormonal antagonists, antidepressants, cardiac antiarrhythmic drugs, isotretinoin, diphenoxylate/atropine, beta-adrenergic antagonists, chemotherapy agents, any other drug with anticholinergic effects
- *Other systemic conditions*: e.g., lymphoma, sarcoidosis
- *Chemical injury*: e.g., lime burn or any other
- *Chronic viral infections*: e.g., hepatitis C, HIV
- *Non-ocular surgery*: e.g., bone marrow transplant, head and neck surgery, trigeminal neuralgia surgery
- Radiation of the orbit or nearby area
- *Neurological conditions*: e.g., Parkinson disease, Bell's palsy, trigeminal neuralgia
- Smoking or exposure to passive smoking
- Technique and frequency of facial washing including eyelid hygiene

### **Examination**

*The physical examination includes*: visual acuity measurement with correction, external eye examination, and slit-lamp biomicroscopy.

The purpose is to:

- Document the signs of dry eye

- Assess the presence and severity of deficient aqueous tear production and/or increased evaporative loss
- Determine other causes of ocular irritation

### **External examination:**

- *Gait*: as in rheumatoid arthritis
- *Hands*: joint deformities characteristic of rheumatoid arthritis
- *Skin*: e.g., scleroderma, florid acne, facial changes consistent with rosacea, SLE
- *Cranial nerve functions*: e.g., trigeminal and facial nerve
- *Proptosis*
- *Eyelids*: incomplete closure/malposition, incomplete or infrequent blink, erythema of the eyelid margins, abnormal deposits or secretions, trichiasis, entropion, ectropion
- *Adnexa*: enlargement of the lacrimal glands

### **Slit-lamp examination:**

- *Eyelashes*: trichiasis, distichiasis, deposits
- *Anterior and posterior eyelid margins*: abnormalities of meibomian glands (e.g., orifice metaplasia, reduced expressible meibum, atrophy), character of meibomian gland secretions [e.g., turbid, thickened (tooth-paste sign), foamy, deficient], vascularization crossing the mucocutaneous junction, keratinization, scarring
- *Puncta*: position, patency, position of plugs if present
- *Tear film*: height of the meniscus, debris, increased viscosity, mucus strands, and foam
- *Conjunctiva*:
  - *Inferior fornix and tarsal conjunctiva*: e.g., mucous threads, gross scarring, stellate scar (in healed trachoma), erythema, papillary reaction, enlarged follicles, keratinization, fornix shortening, symblepharon (especially the medial symblepharon)
  - *Bulbar conjunctiva*: e.g., punctate staining with rose Bengal, fluorescein, or Lissamine green dyes; follicles, Herbert's pit (healed trachoma), hyperemia; localized drying; Bitot's spot, keratinization

- **Cornea:** localized inter-palpebral drying, punctate epithelial erosions, superficial punctate staining with rose Bengal or fluorescein dyes, filamentary keratopathy, epithelial defects, mucous plaques, keratinization, pannus formation, localized dellen, thinning, infiltrates, ulceration, scarring, neovascularization, evidence of cataract, corneal or kerato-refractive surgery

## Diagnostic Tests

- ♦ *For patients with mild irritation symptoms:* a reduced tear break-up time (TBUT) may indicate an unstable tear film with normal aqueous tear production, and there may be minimal or no dye staining of the ocular surface.<sup>60</sup>
- ♦ *For patients with moderate to severe symptoms:* the diagnosis can be made by using one or more of the following tests:
  - *Tear break-up time (TBUT) test* – to evaluate tear-film stability;
  - *Ocular surface dye staining (Fluorescein/rose Bengal/Lissamine green) test:* to evaluate ocular surface disease (KCS);
  - *Schirmer test:* to evaluate aqueous tear production

These tests should be performed in this sequence because the Schirmer test can disrupt tear film stability and cause false-positive ocular-surface dye staining.

### Tear break-up time (TBUT) test

- ♦ It is performed by moistening a fluorescein strip with sterile non- preserved saline and applying it to the inferior tarsal conjunctiva.
- ♦ After several blinks, the tear film is examined using a broad beam of the slit-lamp microscope with a cobalt blue filter.
- ♦ The time lapse between the last blink and the appearance of the first randomly distributed dark discontinuity in the fluorescein-stained tear film is the tear break-up time.
- ♦ The tear break-up time should be evaluated before the instillation of any eye drops and before the eyelids are manipulated in any way.<sup>60</sup>

- ♦ Recurrent tear break-up in the same area may indicate localized anterior basement-membrane abnormalities. Break-up times less than 10 seconds are considered abnormal.<sup>60</sup>
- ♦ A rapid tear break-up time is observed in both aqueous tear deficiency and meibomian gland disease.<sup>60</sup>

### Ocular surface dye staining

Fluorescein, rose Bengal, or Lissamine green dyes are used to assess the extent of ocular surface damage.

- **Fluorescein dye test:** It stains areas of the corneal and conjunctival epithelia where there is sufficient disruption of intercellular junctions to allow the dye to permeate into the tissue.<sup>61</sup> Saline-moistened fluorescein strips is used to stain the tear film. After instilling the dye, the ocular surface is examined through a Slit lamp microscope using a cobalt blue filter. Staining may become more apparent after 1 to 2 minutes. Mild fluorescein staining can be observed in normal eyes and may be more prominent in the morning. Exposure-zone punctate or blotchy fluorescein staining is observed in dry eye, and staining is more easily visualized on the cornea than on the conjunctiva.
- **Rose Bengal staining:** It may be performed using a saline-moistened strip. The saline drop used to moisten the strip should remain in contact with the strip for at least a minute to achieve an adequate concentration of rose Bengal to stain the ocular surface. Patients should be informed that the drop might irritate the eye. Rose Bengal staining is more intense on the conjunctiva than the cornea. The dye stains ocular surface cells that lack a mucous coating as well as debris in the tear film,<sup>61</sup> the staining may be easier to observe with a red-free filter.
- Lissamine green dye: has a staining profile similar to that of rose Bengal<sup>62,63</sup> and may cause less ocular irritation.<sup>63</sup>

### Interpretations:

- ♦ Diffuse corneal and conjunctival staining is commonly seen in viral keratoconjunctivitis and medicamentosa.

- ♦ Staining of the inferior cornea and bulbar conjunctiva is typically observed in patients with staphylococcal blepharitis, MGD, lagophthalmos, and exposure,
- ♦ Staining of the superior bulbar conjunctiva is typically seen in SLK
- ♦ A pattern of exposure zone (interpalpebral) corneal and bulbar conjunctival staining is typically seen with aqueous tear deficiency.<sup>63,64</sup>

### Schirmer Test

- Schirmer test is frequently performed to evaluate aqueous tear production, but it gives variable results and should not be used as the only criterion for diagnosing dry eye.
- It is performed by placing a narrow filter-paper strip (Whatmann Filter paper No: 41) in the lower fornix. Aqueous tear production is measured by the length in millimeters that the strip wets during the test period, generally 5 minutes.<sup>65</sup>
- Schirmer testing may be performed with or without the use of topical anesthesia.

*Schirmer test without anesthesia (basic plus reflex secretion):* Although no absolute cut off has been established for this test, less than 10 mm of strip wetting in 5 minutes is suggestive of abnormality.<sup>68</sup>

- While an isolated abnormal result can be nonspecific, serially consistent low results are highly suggestive of aqueous tear deficiency.
- **Corneal sensation** should be assessed when trigeminal nerve dysfunction is suspected.
- Clinical and laboratory evaluation for autoimmune disorders with the help of Rheumatologist – for patients with significant dry eye, with an autoimmune disorder (e.g., dry mouth), or if there is a family history of an autoimmune disorder.

## Classification/Grading of Dry Eye Disease

Specific systems to classify dry eye severity have been developed by DEWS committee in 2007.<sup>5</sup> However, these are not used widely in clinical practice.

Dry eye disease is generally classified according to a combination of symptoms and signs. In this PPP, it has been classified as mild, moderate and severe based on both symptoms and signs, but with an emphasis on symptoms over signs.<sup>69</sup>

**Table 2: Etiological risk factors in Dry Eye Disease**

Level of Evidence		
Mostly consistent*	Suggestive**	Unclear***
<ul style="list-style-type: none"> <li>• Older age</li> <li>• Female gender</li> <li>• Postmenopausal estrogen therapy</li> <li>• Low dietary intake of Omega-3 fatty acids</li> <li>• Medications Antihistaminics</li> <li>• Connective tissue disorders</li> <li>• LASIK and refractive excimer laser surgery</li> <li>• Radiation therapy</li> <li>• Hematopoietic stem cell transplantation</li> <li>• Vitamin A deficiency</li> <li>• Hepatitis C infection</li> <li>• Androgen deficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Asian ethnicity</li> <li>• Medications: Tricyclic antidepressants</li> <li>• Diuretics</li> <li>• Beta-blockers</li> <li>• Serotonin uptake inhibitors</li> <li>• Diabetes mellitus</li> <li>• HIV/HTLV I infection</li> <li>• Systemic chemotherapy</li> <li>• Large incision ECCE and PK</li> <li>• Retinoids: Isotretinoin</li> <li>• Low humidity environments</li> <li>• Sarcoidosis</li> <li>• Ovarian dysfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Cigarette smoking</li> <li>• Hispanic ethnicity</li> <li>• Medications: Anticholinergics</li> <li>• Anxiolytics</li> <li>• Antipsychotics</li> <li>• Alcohol use</li> <li>• Menopause</li> <li>• Botulinum toxin injection</li> <li>• Acne</li> <li>• Gout</li> <li>• Oral contraceptives</li> <li>• Pregnancy</li> </ul>

\* Mostly consistent evidence implies the existence of at least one adequately powered and otherwise well-conducted study published in peer-review journal along with the existence of a plausible biological rationale and corroborating basic research or clinical data.

\*\* Suggestive evidence implies the existence of either: 1) inconclusive information from peer-review publication or 2) inconclusive or limited information to support the association, but either not published or published somewhere other than peer-review journal.

\*\*\* Unclear evidence implies either directly conflicting information in peer-review publications or inclusive information but with some basis for biological rationale.

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Due to the nature of dry eye disease, this classification is not precise because of overlapping at each level.

- **Mild dry eye disease:** The patients may have symptoms of irritation, itching, soreness, burning, or occasional blurring of vision. It is often difficult to diagnose dry eye definitively in its mild form because of the inconsistent correlation between reported symptoms and clinical signs<sup>67</sup> as well as the relatively poor specificity and/or sensitivity of clinical tests.<sup>66,70</sup> Because most dry eye conditions have a chronic course, repeated observation and reporting of symptoms over time will allow clinical diagnosis of dry eye in most cases.
- **Moderate dry eye disease:** The patients have increased discomfort and frequency of symptoms, and visual effects may become more consistent.
- **Severe dry eye disease:** The patients have increasing frequency of symptoms or constant symptoms, and visual symptoms may be significant and disabling.

Dry eye disease is also loosely classified according to aqueous *tear deficiency (ATD)* and evaporative *tear deficiency (ETD)*, and both of these conditions may be present in patients with the disease. Table 3 lists characteristic findings for each diagnostic test for each condition.

**Table 3: Characteristic Findings for Dry Eye Disease Diagnostic Testing**

	Test	Characteristic findings
Aqueous tear deficiency	Tear break-up time	Less than 10 seconds considered abnormal
	Ocular surface dye staining	Pattern of exposure zone (interpalpebral) corneal and bulbar conjunctival staining - typical
	Aqueous tear production and clearance (Schirmer test)	5 mm or less for Schirmer test with anesthesia considered abnormal
Evaporative Tear Deficiency	Tear break-up time	Less than 10 seconds considered abnormal
	Ocular surface dye staining	Staining of inferior cornea and bulbar conjunctiva - typical

## Management

The aims for treating dry eye disease include:

- Reducing or alleviating signs and symptoms of dry eye
- Maintaining and improving visual function
- Reducing or preventing structural damage

### Treatment Options

- ♦ Patients with dry eye symptoms often have many contributory factors.
- ♦ It is imperative to treat any causative factors that are amenable to treatment.
- ♦ Tear replacement is frequently unsuccessful when used as the sole treatment if additional causative factors are not concomitantly addressed.

For patients with irreversible tear deficiency or evaporative increase associated with chronic conditions such as Sjogren syndrome or blepharitis – ophthalmologist should educate the patient about the natural history and chronic nature of dry eye disease.

- ♦ Realistic expectations for therapeutic goals should be set and discussed with the patient.
- ♦ Patient education is an important aspect of successful management of this condition.

### **Table 4 lists treatments of dry eye syndrome according to the type of therapy used.**

Of these treatments, those particularly *effective for evaporative tear deficiency* include environmental modifications, eyelid therapy for conditions such as blepharitis or meibomianitis, artificial tear substitutes, moisture chamber spectacles, and/or surgery such as trichiasis/entropion or ectropion correction and tarsorrhaphy

- ♦ Specific treatment recommendations depend on the severity and etiological factors of the dry eye disease.
- ♦ The sequence and combination of therapies should be determined on the basis of the patient's needs and preferences and the treating ophthalmologist's medical judgment.

- ♦ Specific therapies may be chosen from any category regardless of the level/grade of disease severity, depending on physician experience and patient preference.

**Table 4: Categories of Dry Eye Treatments**

Type of Therapy	Treatment
• <b>Environmental/ Exogenous</b>	<ul style="list-style-type: none"> <li>• Education and Environment modifications*</li> <li>• Elimination of offending topical and/or systemic medications</li> </ul>
• <b>Medication</b>	
Topical medication	<ul style="list-style-type: none"> <li>• Artificial tear substitutes; gels/ointments*</li> <li>• Anti-inflammatory agents (topical cyclosporine and corticosteroids)</li> <li>• Mucolytic agents</li> <li>• Autologous serum tears</li> </ul>
Systemic medication	<ul style="list-style-type: none"> <li>• Omega 3 fatty acids*</li> <li>• Tetracyclines* (for meibomianitis, rosacea)</li> <li>• Systemic anti-inflammatory agents</li> </ul>
• <b>Surgical</b>	<ul style="list-style-type: none"> <li>• Punctal plugs</li> <li>• Permanent punctal occlusion</li> <li>• Tarsorrhaphy*</li> <li>• Repair of eyelid (malpositions or exposure)*</li> <li>• Mucus membrane, amniotic membrane transplantation</li> </ul>
• <b>Other</b>	<ul style="list-style-type: none"> <li>• Eyelid therapy (warm compress and eyelid hygiene)*</li> <li>• Contact lenses</li> <li>• Moisture chamber spectacles*</li> </ul>
<p>* Particularly helpful for increased evaporative loss</p> <p>Data from Pflugfelder SC (Chair). Management and Therapy Subcommittee of the International Dry Eye Workshop. Management and Therapy of dry eye disease: report of the Management and Therapy Subcommittee of the International Dry Eye Workshop (2007). <i>Ocul Surf</i> 2007;5:163-78.</p>	

**Table 5: lists treatments for dry eye syndrome based on the severity level of the disease.**

### Mild Dry Eye

- ♦ Potentially exacerbating exogenous factors are to be eliminated: such as:
  - o Long-term use of antihistamines, diuretics, beta-blockers, anti-depressant, etc.
  - o Cigarette smoking and passive smoking: may be associated with dry eye because of its adverse effects on the lipid layer of the tear film and tear proteins.<sup>71,72</sup>

**Table 5: Treatment Recommendations for Dry Eye Disease by Disease Severity Level**

Severity Grade	Treatment Recommendations
• Mild	<ul style="list-style-type: none"> <li>• Education and Environment modifications</li> <li>• Elimination of offending topical and/or systemic medications</li> <li>• Aqueous enhancement: Artificial tear substitutes; gels/ ointments</li> <li>• Eyelid therapy (warm compress and eyelid hygiene)</li> <li>• Treatment for contributing ocular factors such as blepharitis or meibomianitis – e.g., Systemic Tetracyclines</li> </ul>
• Moderate	<p><i>In addition to above treatments:</i></p> <ul style="list-style-type: none"> <li>• Anti-inflammatory agents (topical cyclosporine and corticosteroids), systemic Omega-3 fatty acids supplements</li> <li>• Punctal plugs</li> <li>• Spectacle side Shields; Moisture chamber goggles</li> </ul>
• Other	<p><i>In addition to above treatments:</i></p> <ul style="list-style-type: none"> <li>• Systemic cholinergic agonists; Oral pilocarpine, cevimeline</li> <li>• Systemic anti-inflammatory agents</li> <li>• Mucolytic agents</li> <li>• Autologous serum tears</li> <li>• Contact lenses</li> <li>• Permanent punctal occlusion</li> <li>• Repair of eyelid abnormalities (malpositions or exposure)</li> <li>• Tarsorrhaphy</li> <li>• Mucus membrane, amniotic membrane transplantation</li> </ul>
<p>Data from Pflugfelder SC (Chair). Management and Therapy Subcommittee of the International Dry Eye Workshop. Management and Therapy of dry eye disease: report of the Management and Therapy Subcommittee of the International Dry Eye Workshop (2007). <i>Ocul Surf</i> 2007;5:174.</p>	

- o Environmental factors such as air drafts and low-humidity environments.
- ♦ Humidifying ambient air and avoiding air drafts by using shields and by changing the characteristics of airflow at work place, at home, and in the car may be helpful.
- ♦ Measures such as lowering the computer screen to below eye level to decrease lid aperture,<sup>73</sup> scheduling regular breaks, and increasing blink frequency may decrease the discomfort associated with computer and reading activities.

- ♦ Artificial tears in any form like, eye drops and gels, can be used. The use of artificial tears may be increased, but the practicality of frequent tear instillation depends on the lifestyle or manual dexterity of the patient.
- ♦ Artificial tears with preservatives may be sufficient for patients with mild dry eye and an otherwise healthy ocular surface. When tear substitutes are used frequently, (e.g., more than four times a day), non-preserved tears (or with preservative-free on surface) are generally recommended.
- ♦ Contributing ocular factors such as blepharitis or meibomianitis should also be treated (see Appendix).

## Moderate Dry Eye

*In addition to the treatments for mild dry eye, the following management options may be applied:*

- ♦ **Artificial tears:** Non-preserved tears (or with preservative-free on surface) are important. The frequency may be increased from 6-12 times depending upon the patient's need, occupation, and lifestyles.
- ♦ **Anti-inflammatory therapies:** may be considered in addition to tears supplement therapies.
  - **0.05% topical Cyclosporine (FDA approved)** prevents activation and nuclear translocation of cytoplasmic transcription factors that are required for T-cell activation and inflammatory cytokine production. It also inhibits mitochondrial pathways of apoptosis of lacrimal gland and goblet cells. It is available in minim form and to be applied twice daily. While the drop is typically well tolerated, ocular burning was reported in 17% of the patients.<sup>74</sup> It typically takes 3 months for the medication to prove to be effective.<sup>75</sup> A recent study evaluated the efficacy of topical cyclosporine 0.05% in patients with mild, moderate, and severe dry eyes. They demonstrated success in 74%, 72%, and 67% of patients, respectively.<sup>76</sup> With time the dose of topical cyclosporine may be reduced to once daily with equal effect.<sup>77</sup> Pre-treatment with topical loteprednol reduces cyclosporine-induced stinging in chronic dry eye disease.<sup>78</sup>

## Appendix B: Dry Eye Severity Grading Scheme according to DEWS 2007

Dry Eye Severity Level	Level 1	Level 2	Level 3	Level 4#
Discomfort, severity & 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 congestion	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, reduced meniscus height	Filamentary keratitis, mucus clumping, increased tear debris	Filamentary keratitis, mucus clumping, increased tear debris, ulceration
Lid/meibomian glands	MGD variably present	MGD variably present	Frequent	Trichiasis, keratinization, symblepharon
TFBUT (sec)	Variable	≤ 10	≤ 5	immediate
Schirmer score (mm/5min)	Variable	≤ 10	≤ 5	≤ 2

TFBUT = Fluorescein Tear break-up time; MGD = Meibomian gland disease

# Must have Signs AND Symptoms

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- o **Topical Corticosteroids** have been reported to decrease the symptom of ocular irritation, decrease corneal fluorescein staining, and improve filamentary keratitis.<sup>79-81</sup> Loteprednol etabonate 0.5% has been found to be beneficial in patients with KCS with at least a moderate inflammatory component.<sup>79</sup> Low-dose topical corticosteroids therapy can be used at infrequent intervals for 2-week to suppress irritation secondary to inflammation. *Patients prescribed corticosteroids for dry eye should be monitored closely for adverse effects such as increase in intraocular pressure, corneal melting, and cataract formation.*
- ♦ **Systemic Omega-3 fatty acid supplements:** *It has been reported to be potentially beneficial, but there have been few studies analyzing their efficacy. Study suggested that higher dietary intake of Omega-3 fatty acids is associated with a decreased risk of dry eye disease in women.*<sup>82-84</sup>
- ♦ **Punctal occlusion** is considered in ATD dry eye when the medical means of tear substitutes are ineffective or impractical. *It can be done surgically with silicone or thermo-labile polymer plugs that are lodged at the punctal orifice. It is important to perform a temporary punctal occlusion first with collagen plugs to test its effect.*
  - o Silicone plugs placed in the punctum, and both silicone and collagen plugs placed in the canaliculus have been shown to improve dry eye signs and symptoms.<sup>85-88</sup> Punctal plugs have the advantage of being removable if the patient develops symptoms of epiphora, and they may be retained for many years without complications, provided they are appropriately sized.<sup>89</sup>
  - o Intracanalicular thermolabile polymer plugs may offer ease of insertion and a decreased chance of extrusion, but they have been associated with the occurrence of epiphora, canaliculitis, and dacryocystitis.<sup>90</sup>
- ♦ *Spectacles with side-shields or moisture chamber goggles are noninvasive therapies that can be used, but cosmetically may not be accepted.*

## Severe Dry Eye

In addition to the treatments for mild and moderate dry eye, the following treatments may be considered:

- ♦ **Oral cholinergic agonists:** Oral Pilocarpine and cevimeline, have been approved by the FDA to treat the symptoms of dry mouth in patients with Sjögren syndrome.<sup>91,92,94</sup> These medications bind to muscarinic receptors, which stimulate secretion of the salivary and sweat glands, and they appear to improve tear production.<sup>91,92</sup>
  - *Oral Pilocarpine* (5mg) 4 times daily-causes a significant overall improvement.<sup>91,93</sup> The most common side effect is excessive sweating, in 40% of patients. 2% of the patients taking oral pilocarpine withdrew from the studies because of this and other side effects.
  - *Oral Cevimeline* (30mg) 3 times daily, is another cholinergic agonist that has been found to improve ocular irritation symptoms and aqueous tear production.<sup>92</sup> This agent may have fewer adverse systemic side effects than oral pilocarpine.
- ♦ *Systemic immunosuppressants:* for patients with systemic disease such as rheumatoid arthritis, progressive systemic sclerosis or SLE.
- ♦ *Autologous serum drops:* have been reported to improve ocular irritation symptoms as well as conjunctival and corneal dye staining in patients with Sjögren syndrome<sup>95</sup> and GVHD.<sup>96</sup>
- ♦ *Topical acetylcysteine* (10%), a mucolytic agent used four times a day to treat filamentary keratitis.<sup>97</sup> Filaments can also be debrided with a cotton-tip applicator, dry cellulose sponge, or with a blunt forceps. Soft contact lenses are effective in preventing recurrence of filamentary keratopathy but are poorly tolerated if the patient has severe dry eye.

If the patient has associated neurotropic keratopathy, contact lenses should be avoided.

- ♦ *Correction of eyelid abnormalities:* resulting from blepharitis, trichiasis, or lid malposition (e.g., lagophthalmos, entropion/ectropion) may be considered prior to permanent punctal occlusion.<sup>98</sup>

- ♦ **Permanent irreversible punctal occlusion:** can also be accomplished by means of thermal or laser cautery. If occlusion with cautery is planned, a trial occlusion with temporary collagen plugs generally should be performed first to screen for the potential development of epiphora. A stepwise approach to cautery occlusion is generally recommended so that no more than one punctum is cauterized in each eye at a treatment session. In general, laser cautery is not as effective as thermal cautery in achieving permanent, complete occlusion.
- ♦ **Tarsorrhaphy:** may be required to decrease tear evaporation in patients with severe dry eye who have not responded to other therapies.<sup>99</sup>
- ♦ **Botulinum toxins:** may be required to induce ptosis to decrease tear evaporation in patients with severe dry eye Repeat injection may require in many situations.<sup>100</sup>

## Prevention & Early detection

Dry Eye Syndrome itself cannot be prevented, notably because most of the cases are due to the aging process. However, these guide lines are helpful to ease the discomfort and further complications.

- ♦ **To avoid excessive air movement:** windy conditions – outside or inside
- ♦ **To avoid hot, dry environments and to add moisture to the air:** A humidifier can be used to keep the air moist. Air conditioning is as bad as heaters for increasing the evaporation of your tears.
- ♦ **To wear glasses on windy days and goggles while swimming:** The wraparound style of glasses may help reduce the effects of the wind. Goggles protect your eyes from chemicals in pool water that can dry your eyes.
- ♦ **To take frequent breaks:** While watching TV, reading or working at a computer.
- ♦ **To position the computer screen below eye level:** Computer screen below eye level keeps the eye open narrowly. This may help slow the evaporation of tears between eye blinks.

- ♦ **To stop smoking and avoid passive smoking:** Smoke can worsen dry eye symptoms.
- ♦ **To use hot compresses and eye massage:** Particularly for blepharitis, meibomianitis and related conditions.<sup>100</sup>
- ♦ **To instill artificial tears/lubricating gels:** as soon as there is suspicion of dry eye disease and close follow up to detect the dry eye disease early.

## Follow-up

- ♦ To assess the response of the therapy as a basis for altering/adjusting treatment as necessary.
- ♦ To monitor for structural ocular damage, and
- ♦ To provide reassurance and constant counselling.
- ♦ The frequency and extent of the follow-up evaluation will depend on the severity of disease, the therapeutic approach, and the response to the therapy. For example, patients with sterile corneal ulceration associated with dry eye may require daily follow-up.

## Level of care

**Primary level:** at PHC, BPHC and district level by non-ophthalmologist eye care providers (optometrists, ophthalmic assistants or non- ophthalmologist physicians)

- To take proper ocular and medical history to identify the disease and associated risk factors
- To start treatment in case of mild dry eye.
- To guide and to counsel the patient
- To refer the patient promptly to the secondary/tertiary level in any doubt like:
  - Exacerbation of symptoms
  - Blurring of vision
  - No response to artificial tears
  - Any red eye/lid abnormalities
  - Positive systemic history, like rheumatoid arthritis

**Secondary level:** at district level by comprehensive ophthalmologist or ophthalmologists of other subspecialties.

- To perform common dry eye tests to grade the severity of the disease
- To treat mild to moderate dry eye.
- To refer the patient promptly to the tertiary level if any of the following occurs:
  - Visual loss
  - Moderate or severe pain
  - Lack of response to the therapy
  - Corneal infiltration or ulceration

**Tertiary level:** at medical colleges, tertiary eye institutes or by specialist ophthalmologists

- To treat and manage patients of dry eye disease at any level.
- To find out etiological factors responsible
- To treat any complications – in patients with severe dry eye.
- To train comprehensive ophthalmologists

## Referral

- ♦ Referral of a patient with dry eye may be necessary, depending on the severity of the condition and its responsiveness to treatment.
- ♦ In moderate to severe cases that are unresponsive to treatment or when systemic disease is suspected, timely referral to a specialist Ophthalmologist who is knowledgeable and experienced in the management of these entities is recommended.
- ♦ Referral to medical specialist or rheumatologist can be considered for patients with systemic immune dysfunction or for those who require immunosuppressive therapy. For connective tissue disease such as rheumatoid arthritis.

## Counselling

- ♦ The most important aspects of caring for patients with dry eye are to educate them about the chronic nature of the disease process and to provide specific instructions for therapeutic regimens.
- ♦ It is helpful to reassess periodically the patient's compliance and understanding of the disease, the risks for associated structural changes, and to re-inform the patient as necessary. The patient and physician together can establish realistic expectations for effective management.
- ♦ Patients with severe dry eye are at greater risk for contact lens intolerance and associated complications.
- ♦ Patients with pre-existing dry eye should be cautioned that refractive surgery may worsen their dry eye condition. Patients who have dry eye and are considering refractive surgery should have the dry eye treated before surgery.<sup>101,102</sup>
- ♦ Some patients may benefit from professional counselling as an aid in coping with the chronic disease state as in meibomianitis.

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## Suggested Additional Reading Materials & Source

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## Summary of the topic and Major Recommendations

- ♦ Dry eye is a multi-factorial disease of the tears and ocular surface that results in discomfort, visual disturbance and tear-film instability with potential damage to the ocular surface, and accompanied by increased tear osmolality and inflammation.
- ♦ Many recent studies have given insight into the inflammatory etiology of dry eye.
- ♦ The diagnosis of dry eye is often difficult because of lack of sufficiently discriminatory clinical diagnostic techniques that provide consistent and unambiguous results.
- ♦ Its management can be a frustrating experience for both patient and their eye-care providers.
- ♦ The conventional approach to the management of dry eye with tear substitutes is not enough in moderate to severe dry eye.
- ♦ The newer treatment approach is to target the underlying risk factors of dry eye instead of conventional symptomatic relief.

## Diagnosis

The initial evaluation of a patient with symptoms suggestive of dry eye should include comprehensive medical eye evaluation relevant to dry eye.

### Patient History

- ◆ Symptoms with duration; Exacerbating conditions
- ◆ Topical medications used, their frequency, and their effect on symptoms
- ◆ Contact lens wear, schedule, and care
- ◆ Allergic conjunctivitis history
- ◆ Chemical injury; Radiation of the orbit
- ◆ Ocular surgical history
- ◆ Punctal surgery; Eyelid surgery
- ◆ Menopause; oral hormonal therapy
- ◆ Systemic autoimmune connective tissue disorders
- ◆ Other systemic conditions
- ◆ Systemic medications
- ◆ Dry mouth, dental cavities, oral ulcers
- ◆ Atopy or other Dermatological diseases;
- ◆ Chronic viral infections
- ◆ Neurological conditions
- ◆ Smoking or passive smoking
- ◆ Technique of facial washing including eyelid hygiene

**Examination:** The physical examination includes – testing visual acuity, an external examination, and slitlamp biomicroscopy.

*External examination for:*

- ◆ Gait
- ◆ Hands
- ◆ Skin
- ◆ Eyelids
- ◆ Adnexa
- ◆ Proptosis
- ◆ Cranial nerve function

*The slit-lamp biomicroscopy should focus on:*

- ♦ Eyelashes, Anterior and posterior eyelid margins, Puncta
- ♦ Tear film, Tear meniscus height
- ♦ Conjunctiva: Inferior fornix and tarsal conjunctiva; bulbar conjunctiva
- ♦ Cornea

### **Diagnostic Tests**

- ♦ Tear break-up time (TBUT) test
- ♦ Ocular surface dye (Fluorescein/Rose Bengal/Lissamine Green) staining test
- ♦ Schirmer test
- ♦ Corneal sensation should be assessed when trigeminal nerve dysfunction is suspected.
- ♦ A laboratory and clinical evaluation for autoimmune disorders should be considered for patients with significant dry eye

### **Treatment**

- ♦ Specific treatment recommendations depend on the severity and source of the dry eye.
- ♦ Sequence and combination of therapies should be determined on the basis of the patient's needs and preferences and the treating ophthalmologist's medical judgment.
- ♦ Treatments for dry eye disease should be based on the severity level of the disease.
- ♦ Specific therapies may be chosen from any category regardless of the level of disease severity, depending on physician experience and patient preference.

### **Follow-up**

The frequency and extent of the follow-up evaluation will depend on the severity of disease, the therapeutic approach, and the response to the therapy. For example, sterile corneal ulceration associated with dry eye may require daily follow-up.

## **Provider and Setting**

Patients evaluated by general ophthalmologist or non-ophthalmologist health care providers should be referred promptly to the specialist ophthalmologist in following situations:

- ♦ Visual loss
- ♦ Moderate or severe pain
- ♦ Lack of response to the therapy
- ♦ Corneal infiltration or ulceration

## **Counseling/Referral**

- ♦ To educate the patient about the chronic nature of the disease process.
- ♦ To provide specific instructions for therapeutic regimens.
- ♦ To reassess periodically for patient's compliance and understanding of the disease, the risks for associated structural changes, and to re-inform the patient as necessary.
- ♦ Patients with pre-existing dry eye should be cautioned that refractive surgery may worsen their dry eye condition. Patients who have dry eye and are considering refractive surgery should have the dry eye treated before surgery.



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