



Handling dry eye and its complications

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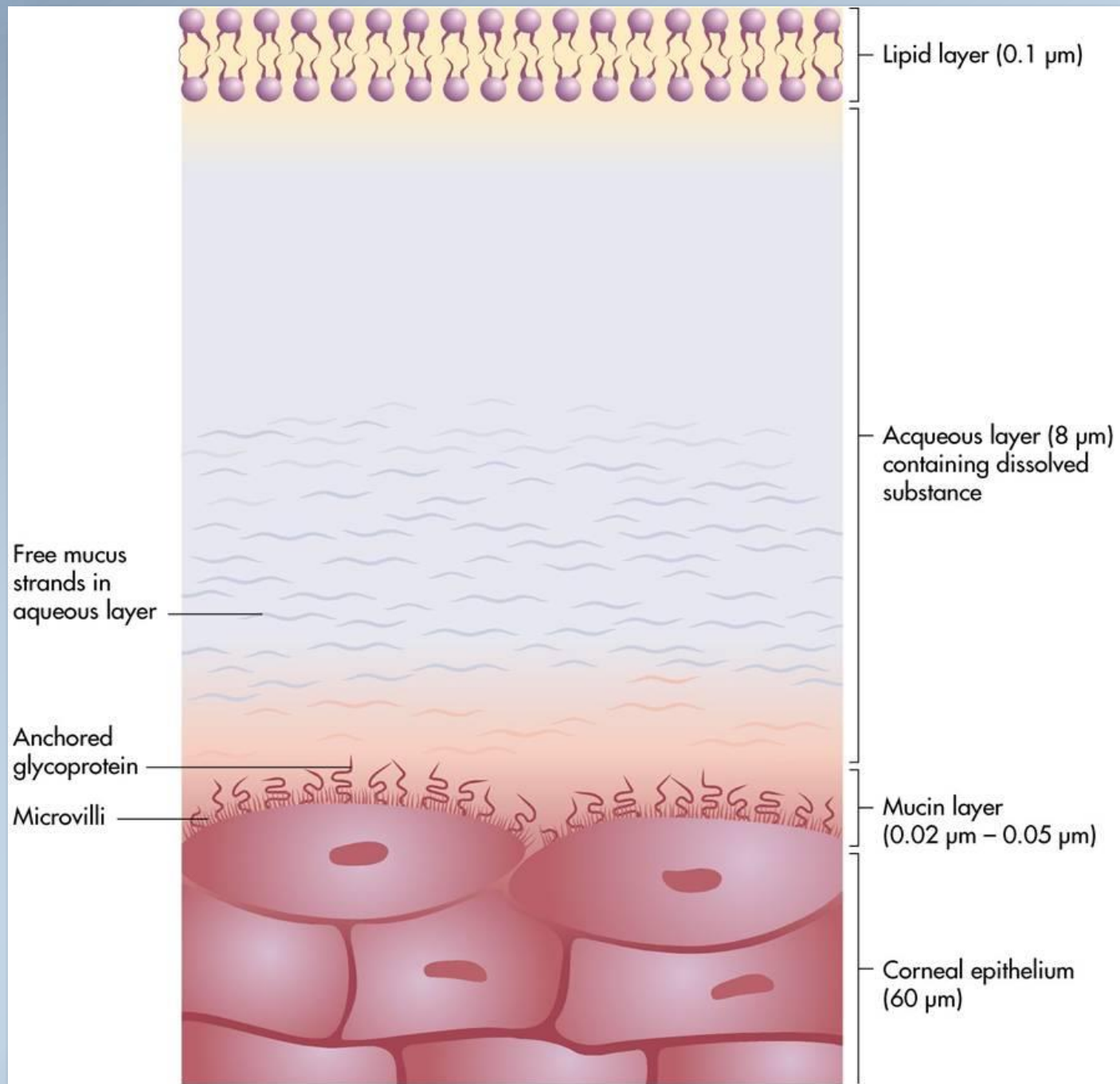
Keratoconjunctivitis sicca (KCS)

- Ocular conditions account for about **ten percent** of canine consultations in first-opinion practice₁
- Dry eye affects nearly **5%** of all dogs₂
- Up to **20%** of predisposed breeds₃
- **46%** of dog owners in a recent survey were not aware that their pet could suffer from dry eye₄

The normal tear film

- The normal tear film (also called the precorneal tear film) consists of three major components:
- **Mucous layer** – produced by conjunctival goblet cells, by the epithelial cells of the cornea and conjunctiva
- **Aqueous layer** – produced by the lacrimal and nictitans glands
- **Lipid layer** – produced by meibomian glands in the eyelid margin

Picture below was generated by Vismed Trbchemedica



The normal tear film

- **The aqueous layer of the tear film:**
- 98.2% water and 1.8% solids, including immunoglobulins (IgA, IgG, IgM), lysozyme, lactoferrin, transferrin, ceruloplasmin and glycoproteins.^{7,8}
- Without a normal aqueous layer, the corneal surface is at risk of bacterial infection, hypoxia, toxic tissue metabolite accumulation and excessive degradation which will cause a **quantitative dry eye**

The normal tear film

- **Lipid layer:**
- Provides a thin, oily components, which **retards evaporation** and promote a stable, even spread of tears over the cornea.
- The resultant loss of the normal oily covering may allow **premature dispersion of the aqueous layer**. Abnormal lipids may also be toxic to the surface of the cornea.
- Disease of the meibomian glands manifests as a marginal **blepharitis** and causes a **qualitative KCS**.

The normal tear film

- **Mucous layer:**
- Composed of mucin, immunoglobulins, urea, salts, glucose, leukocytes, cellular debris and enzymes.
- Helps provide a **smooth refractive** surface over the cornea, **lubricate the** cornea and conjunctiva and **anchor** the aqueous layer to the corneal epithelium.
- Reduced production of mucin results in **loss of tear stability** with subsequent **bacterial adherence and desiccation** which results in a **qualitative KCS**.

The normal tear film

- **The tear film plays a vital role in maintaining ocular health:**
- **Lubricates** the cornea, eyelids and conjunctiva
- Provides **oxygen** and nutrients (e.g. glucose and electrolytes) to the cornea; vital due to its avascular nature
- **Removes** metabolic by-products (carbon dioxide and lactic acid)
- Aids removal of irritants
- Allows **white blood cells** to access the cornea and conjunctiva
- Plays a role in **local immune defence** of ocular surface

Aetiology of KCS

- **Immune mediated**

- Most **common cause** affects the lacrimal and nictitans glands
- more common in certain breeds such as
 - WHWT
 - English Bulldog
 - Pug
 - Yorkshire Terriers
 - American Cocker Spaniels
 - Pekingese
 - Miniature Schnauzers
 - English Springer Spaniels



Aetiology of KCS

- **Systemic diseases**

- Hypothyroidism₉
- Diabetes mellitus₉
- Hyperadrenocorticism₉

- **Drug induced**

- Sulfonamides
- Topical and systemic atropine
- Following sedation/GA (reduces tear production for at least 24 hours)₁₀

Aetiology of KCS

- **Congenital**

- Hypoplasia or aplasia of the lacrimal gland
- Usually unilateral
- Dogs present with severe corneal dryness
- Usually in miniature breeds
- Uncommon

Aetiology of KCS

Neurogenic

- Loss of parasympathetic innervation to the lacrimal gland
(facial nerve)
- Loss of sensory innervation to the ocular surface
(trigeminal nerve)
- Idiopathic or as a result of the inner ear disease/trauma/neoplasia

Aetiology of KCS

- **Iatrogenic**

- Removal of nictitans gland or third eyelid

- **Infectious causes**

- Distemper

- **Other**

- Prolapsed nictitans gland

- Trauma to the orbit affecting the tear glands

Clinical signs of KCS



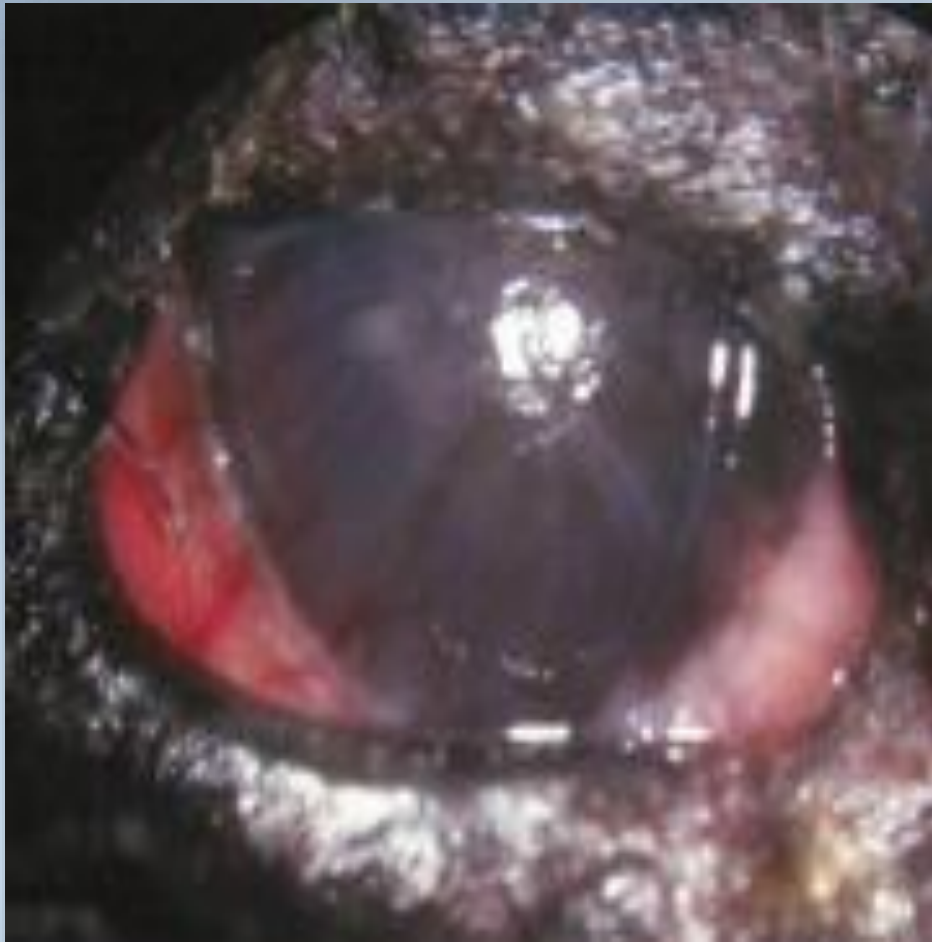
- **Acute onset**
- Conjunctival hyperaemia
- Mucopurulent discharge
- Periocular crusting
- Severe blepharospasm

Clinical signs of KCS



- +/- Corneal ulceration – likely to rapidly deteriorate if left untreated (may lead to Keratomalacia or globe rupture)
- KCS can present acutely, but this is less common than a chronic presentation

Clinical signs of KCS



- **Chronic – Early Stages:**
- Low grade, uncontrolled chronic KCS
- Conjunctival hyperaemia is evident along with a mucoid discharge
- Neovascularization of the cornea can be seen
- Often subtle signs initially

Clinical signs of KCS



- **Chronic – Later Stages:**
- Blepharospasm
- Photophobia
- Worsening conjunctival hyperaemia
- Increasing, persistent mucopurulent discharge
- Corneal vascularization, dense pigmentation and scarring
- +/- Corneal ulceration- often small and may rapidly worsen

Clinical signs of KCS



- **Chronic – Later Stages:**
- Densely pigmented cornea, likely to have diminished visual acuity
- Note that the camera flash reflection is not sharp, which is indicative of an irregular corneal surface

Case work up

- Take full clinical history
- Full ophthalmic examination
- Full physical examination
- Swab taken for culture and sensitivity from corneal edge or discharge, to be taken before topical anaesthesia
- Bloods need to be considered if suspect systemic condition may cause KCS

Diagnosis:



KCS can commonly be misdiagnosed as bacterial conjunctivitis due to the persistent mucopurulent ocular discharge

Diagnosis

- KCS is diagnosed by performing a Schirmer Tear Test (STT);
there are two types: STT-1 and STT-2
- **STT-1**
- Most commonly performed
- No local anaesthetic used
- **Measures reflex and basal tear productions**

Diagnosis

- **STT-2**
- Local anaesthetic used
- **Measures basal tear production only**
- Performed in order to eliminate the reflex tear component, which can be useful in painful eyes

Diagnosis

- **To perform a STT-1:**
- Bend the STT strip at the notch whilst still in the packet
(if the strips are touched on the corneal contact area they will not be sterile and the grease from fingers may compromise the result)
- Place the short section of the bent strip into the lateral half of the lower eyelid, ensure there is contact with the corneal surface to cause reflex tear production
- Measure for a full minute

Diagnosis



Diagnosis

- **To perform a STT-2:**
- Apply a drop of topical local anaesthetic to the eye (e.g. 0.5% Proxymetacaine)
- After approximately one minute, gently dry the conjunctival sac with a sterile cotton bud or bacteriology swab
- The STT paper strip can then be applied for one minute. It is important to perform any STT over 60 seconds, as it has been shown that the paper strips do not absorb the tears in a linear fashion.¹¹
- Timing over 15 or 30 seconds may therefore provide false results
- STT-2 readings are usually **half the STT-1** readings and a normal dog will record **7mm/min**

Interpreting STT-1 results

Reading in mm/minute	Interpretation	Action required
0-10	Insufficient tear production	Treatment is required
10-15	Lower than normal	Treatment may be required, monitoring is very important
15-25	Normal	
>25	Normal or excessive	Occasionally needs investigation

Key Points to Consider

- A **sore eye** may have a **normal reading**, as a result of ocular **pain** and increased tearing, whilst the **other eye** may have a **low reading** suggestive of underlying KCS
- Equally an **ulcerated eye** with a **borderline reading** would be of **concern** as a much higher result would be expected due to reflex tearing
- Any red or ulcerated eye should have an STT performed (unless deep ulceration is present, and the integrity of the cornea is fragile)

Key Points to Consider

- In any case where **KCS is suspected** it is important to assess both eyes for evidence of **ulcerative keratitis**, if discharge is present it should be removed very gently to avoid exacerbating a pre-existing ulcer
- **Predisposed breeds** should recommend **regular STTs** carried out – at vaccinations and check-ups
- If you suspect KCS, but obtain a normal STT reading, advise the owner to have a repeat check in a few weeks

Treatment



Treatment

- **Treatment** should be based on **aetiology**. As **most cases** of **KCS are immune-mediated** (although the exact prevalence remains unknown) the treatment options below focus on **immune-mediated KCS**.
- The majority of cases are managed medically and require treatment for life.

Treatment

- **Antibiotic:**
- **Broad spectrum antibiotic topically**, pending the result of culture and sensitivity testing
- If any blepharitis is present, as is often the case with refractory KCS (especially in Cocker Spaniels) treat with 2-3 week course of systemic antibiotic

Treatment

- **Cyclosporine:**
- 0.2% cyclosporine is indicated for the treatment of **immune-mediated KCS**
- Cyclosporine A exerts its **immunosuppressive and anti-inflammatory** effects by inhibiting the production of cytokines which **up-regulate T-helper cell activity**. This restores the function of lacrimal acinar epithelium under autoimmune attack and reduces infiltration of ocular tissues by inflammatory cells
- Direct **lacrimomimetic** effect by blocking the inhibition of tear production by **prolactin**

Treatment

- **Cyclosporine: (CsA)**
- An increase in tear production is expected within **10-14 days**, but may not be maximal until six weeks from the commencement of therapy
- The majority of dogs require lifelong treatment
- **Outcome:**
 - **STT > 2 mm** generate a response of approximately **80%**
 - **STT < 1 mm** only **50%** of cases respond to CsA

Treatment

- **Cyclosporine:**
- I normally **repeat STT-1** assessment after **10-14** days of cyclosporine therapy
- It has been recommended that carrying out an **STT three hours** following the **application of topical cyclosporine**, provides the most accurate assessment of response to therapy¹³

Treatment

- **Artificial Tears/Tear Supplements**
- Only **supplemental** and should **not be viewed as a replacement**
- Should be **used in addition to cyclosporine**; this is especially important at the **start of therapy** due to the time it takes for cyclosporine to have an effect on tear production

Treatment

- **What are the options?**
- **Hypromellose-based** products tend to require very frequent application, often once every **1-2 hours**
- **Carbomer-based** products have **increased viscosity** compared to hypromellose products, but usually require application around every **4-6 hours**

Treatment

- **Hyaluronic based products;**
- Hyaluronic is a naturally occurring molecule that plays a crucial role in **maintaining tissue hydration**₁₄, depending on the product it can be applied from **2-4 times daily**

Ongoing management

- Once KCS has been diagnosed and treatment commenced, **STTs should be performed regularly** to monitor progress.

The interval between STTs can be increased once the condition is stable.

- Owner education about the **lifelong nature** of the disease is vitally important for successful ongoing disease management.

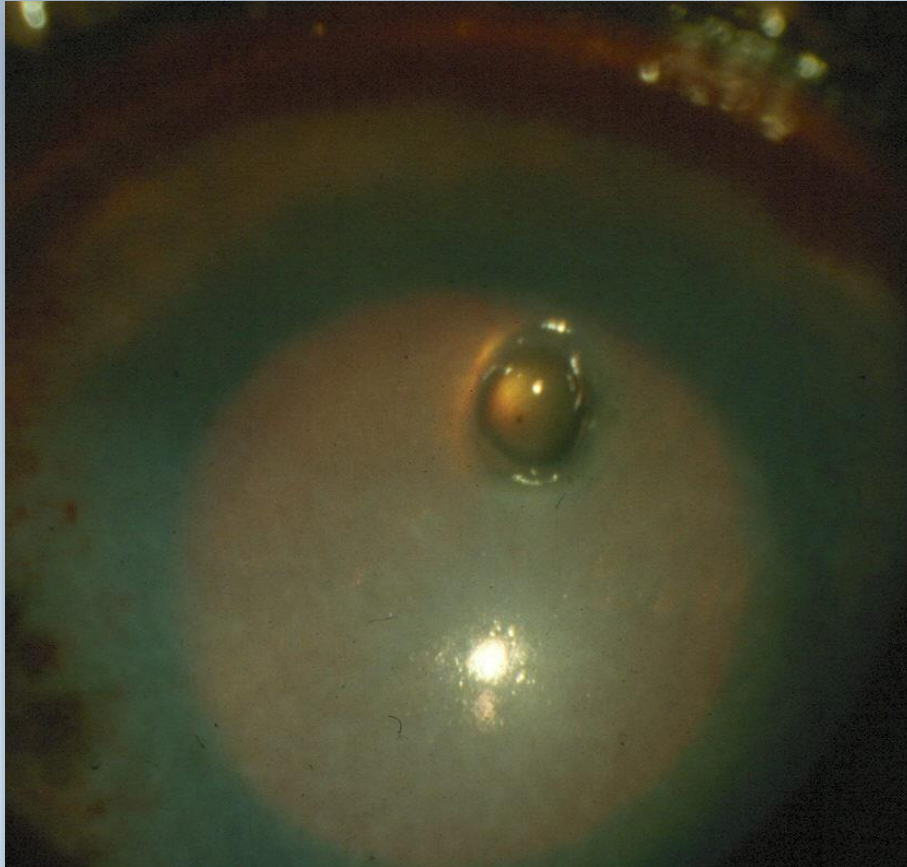
Ongoing management

- If a **STT result is low** despite cyclosporine and lubricants for **12 weeks**, consideration may need to be given to using an off-label preparation or consider referral
- **Off-label preparation:**
 - Higher concentration of cyclosporine
 - Tacrolimus ocular preparation (based on the cascade)

Complicated KCS



Complicated KCS



- A **deep corneal ulceration**
- Cases that are **refractory to medical treatment** which may require a parotid duct transposition (PDT) surgery

Complicated KCS

- Unfortunately, deep stromal ulceration and keratomalacia (melting ulcer) can develop with uncontrolled KCS and can lead to corneal rupture. These cases can often be effectively treated with intensive medical and surgical management, and required urgent treatment

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- Pictures are curtesy of Dr David Williams

THE END

