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• differentiating patients with primary disease affecting the eyelids / periocular skin rather than surface ocular conditions (i.e. affecting the cornea or conjunctiva) is often difficult
• these conditions are often concurrent
• part of the initial assessment should be aimed at determining if the condition is primarily an eyelid disease or an ocular with secondary eyelid disease (i.e. allergic conjunctivitis leading to secondary trauma/ eyelid maceration etc), or
• this distinction is not always obvious (generally the more severe the eyelid disease the more likely this is the primary disease process)

• Investigation of eyelid disorders & periocular skin disease
• history
• physical examination
• dermatological examination
• ophthalmological examination

• diagnostic approach to eyelid disease
• identify eyelid disorders causing mechanical irritation of the eye (conformational eyelid disorders, distichia, trichiasis etc)
• search for parasites and dermatophytes
• determine if eyelid infection is present
• consider irritant / allergic disease last
• biopsy eyelid when there is ulceration, mass lesions or persistence despite diagnostics/ treatments

• diagnostic approach to eyelid disease
  1. identify eyelid disorders causing mechanical irritation of the eye (conformational eyelid disorders, distichia, trichiasis etc)

• gross evaluation of the patient, once relaxed and without restraint
• best to perform initial assessment on the floor
• gross examination of the eye and adnexa

CASE 1: 5yo MN ECS discharging eye (OS)
Diagnostic approach to eyelid disease
2. search for parasites and dermatophytes

- tape strip cytology (Sellotape impression of the eyelid skin)
  - rapid evaluation of cells, bacteria and Malassezia on the periocular skin surface
  - clear adhesive tape* pressed onto affected skin to gather squames and micro-organisms
  - stained with a small volume of methylene blue or Diff Quik® stain on a microscope slide
  - examined at low power to identify areas where inflammatory cells may be present then high power under oil immersion to look for micro-organisms and the inflammatory cells in more detail
  - *Scotch® tape: as some others dissolve or go cloudy in stains
  - more than 5 Malassezia per hpf: is often stated in text books as the magic number when they cause disease, but this is controversial– if there are lesions plus yeast present on cytology treatment should be considered
  - large numbers of bacteria especially if associated with PMN’s (intracellular bacteria)

CASE 2: 2yo ME G Dane discharging eye (OS)
• **hair plucks**
  - assess for the presence of pruritus (trichogram) look for chewed or broken hairs
  - initial examination for demodex spp (LP) and dermatophyte arthrospores (X 40)
  - rapid and easy to perform BUT false negative may occur
  - cases of suspected dermatophytosis or demodicosis should be followed up by fungal culture or skin scrapes respectively.

• **skin scrapes**
  - care around eye
  - guard blade to avoid serious injury if patient moves can also use the blunt end of the blade or a curette
  - useful for demodex spp: n.b. study indicates that they are as sensitive as skin scrapes if the hair plucks are performed over 1 cm²

• **fungal culture**
  - may perform “in house” but carefully read instructions as non pathogenic fungi can also induce the colour change considered diagnostic
  - fungal growth with an appropriate appearance and the colour change must be seen simultaneously
  - cultures need to be checked daily
  - “McKenzie toothbrush technique” useful around the eye (any new toothbrush is mycologically sterile)

• **diagnostic approach to eyelid disease**

  3. determine if eyelid infection is present

  • **clinical appearance**
  • **sticky tape impression cytology**: all cases
  • **culture and sensitivity**: esp. if rods present or failure to respond to appropriate antibiotic treatment
diagnostic approach to eyelid disease

4. consider irritant / allergic disease last

allergy work-up
- history and clinical signs - may be suggestive
- rule out other causes of pruritus & periocular excoriation
- control secondary infections - treating for bacterial infection may improve but not resolve the condition
- cytology
  - typically small plasma cells, lymphocytes and some eosinophils
  - typical mast cell & eosinophil populations seen in man not seen in domestic animals
  - conjunctival biopsy
    - may be useful in cases of suspected atopic blepharitis / conjunctivitis
    - biopsies reveal goblet cell production, eosinophil & mast cell infiltration and mononuclear infiltration (predominately T cell subsets)
    - in man there can be extensive mast cell proliferation
- elimination diet
- atopic dermatitis (consider last as this is a diagnosis of exclusion)
- intradermal tests
- changing environment and making a link with environmental exposure

5. biopsy eyelid when there is ulceration, mass lesions or persistence despite diagnostics/ treatments

biopsy
- indicated when there is ulceration, mass lesions or persistence despite diagnostics/ treatments
- biopsies including the lid margin if possible as this allows assessment of the mucocutaneous junction & meibomian glands
• anatomy and physiology
  • Meibomian glands are modified sebaceous glands that produce “meibum” a viscous oil/wax secretion
  • Zeiss glands are sebaceous glands associated with the cilia
  • Moll’s glands are modified epithelial sweat glands associated with the cilia

CASE 4: 5yo MN WHWT (Jammy Dodger)
discharging eye (OS) and periocular dermatopathy

CASE 5: 5yo MN X bred
discharging eye (OS) and periocular dermatopathy

• INVESTIGATION & MANAGEMENT OF EYELID DISORDERS & PERIOCULAR SKIN DISEASE
bacteria commonly isolated from the eyelid skin:
- Staphylococcus intermedius (recently re-classified as Staphylococcus pseudintermedius)
- Staphylococci spp (coagulase-negative)
- Corynebacterium spp

blepharitis / dermatitis

clinical signs
- redness
- oedema
- hair loss
- chronically – lichenification, hyperpigmentation and sometimes scarring

aetiology of eyelid disease

infections (bacterial, fungal (dermatophytes, Malassezia), viral)
- parasites
- allergic skin disease (cutaneous adverse food reactions, atopic dermatitis and contact dermatitis)

other
- immune mediated
- neoplasms
- endocrine
- nutritional
- idiopathic …..

LOCALIZED EYELID DISEASE
- DIFFUSE EYELID DISEASE
- MARGINAL EYELID DISEASE (see canine pre-corneal tear film disorders)

LOCALIZED EYELID DISEASE

inflammatory lesions
- internal hordeolum
- inflammation meibomian gland

external hordeolum
- inflammation involving the gland of Zeiss or Moll

chalazion
- chronic inspissation of meibomian gland with meibum

treatment
- early cases antibiotics and hot compresses
- recalcitrant cases - excision or curettage

neoplastic disease
- primary eyelid tumours common in dogs- usually benign

sebaceous gland tumours
- melanomas
- papillomas
- account for approximately 80% eyelid neoplasms

treatment
- excision with full thickness wedge resection usually curative
- other eyelid plastic surgery techniques when more than a third of the eyelid margin is affected
• squamous cell carcinoma
• adenocarcinoma

• treatment
• excision + ancillary treatment (Sr$^{90}$ plesiotherapy or cryotherapy)

• DIFFUSE EYLIID DISEASE

• bacterial pyoderma
• 90% of superficial pyodermas are caused by Staphyloccocus intermedius.
• this is a gram positive coagulase positive Staphylococcus
• primary pyodermas are rare and there is usually always an underlying cause for pyoderma

• surface pyoderma
• this is when the infection is limited to the stratum corneum and examples include: skin fold infection (intertrigo) or pyotraumatic dermatitis (hot spots)

• intertrigo
• typically seen in the brachycephalic breeds and the Sharpei due to their skin folds
• pruritus, erythema, alopecia, greasy exudate within the fold.
• facial rubbing especially when there is secondary infection
• causes discomfort to the patient

• pyotraumatic dermatitis
• this is an exudative and extremely pruritic lesion, which usually occurs secondary to scratching around the eye
• other causes can include: poor ventilation and skin humidity i.e the environment often created by skin folds
• clinical signs: alopecia, erosion of the skin, intense pruritus
• this may develop into a superficial folliculitis if not treated promptly
• if satellite papules and pustules are seen in conjunction with thick crusting then this is a superficial pyoderma (see below)

• treatment
• identify the underlying problem
• topical medications
• aim of topical treatment is to remove debris and reduce bacterial load

• superficial pyoderma
• this is when the infection involves the infundibular portion of the hair follicles and epidermis
• bacterial folliculitis is the most common type seen around the eyes
• clinical signs: erythema, papules, follicular pustules, crusting, patchy alopecia.

• papules are the most commonly observed sign, although these may be difficult to visualize around the eye
• common causes around the eyes: demodicosis, dermatophytosis. Exclude these by hair plucks and fungal cultures

• treatment
• topical therapy if possible
• systemic antibiotics always required in addition to topical therapy
• choose appropriate antibiotic: for example
  – cefalexin 15-25mg/kg BID
  – clindamycin (11mg/kg uid or 5.5mg/kg BID). This is not always a good choice for a recurrent infection as resistance can develop
  – potentiated sulphonamides
• minimum of three weeks and one week beyond clinical resolution
local treatments for blepharitis

**warm compresses followed by eyelid scrubs**
removes the eyelid debris, reduces the bacterial load and helps stabilize the tear film by releasing oily secretions from the meibomian glands

**warm compresses** –
soak gauze swabs in water (warm as tolerable) - placed on closed eyelids with gentle pressure for 5 minutes BID

**eyelid scrubs** -
Johnson’s baby shampoo – diluted one-to-one with water
applied to eyelid using a gauze swab wrapped around a finger or cotton tipped applicator to gentle scrub the eyelids for 1 minute
soap flushed away using 1:50 povidone iodine solution (diluted in 0.9% saline solution)

**topical steroid and antibiotic preparations**

- **deep pyoderma**
  - this is when the infection affects the whole hair follicle, dermis and sometimes subcutis
  - sometimes furunculosis (the rupture of a hair follicle) is seen which can be seen as a progression of superficial pyoderma, or secondary to demodicosis and dermatophytosis
  - clinical signs: ulcerative crusted lesions, swelling, purulent to haemorrhagic exudate
  - PAIN!
  - the causal agent and antibiotic sensitivity is not as predictable in deep pyoderma as in cases with superficial pyoderma and so culture and sensitivity should be performed, especially if rods are present on cytology

- **treatment**
  - identify underlying cause
  - systemic antibiotics
  - extended course and continued at least 2 weeks beyond complete clinical cure
  - suitable antibiotics include:
    - cephalexin (15-25 mg/kg bid)
    - amoxicillin and clavulanic acid
    - fluoroquinolones
  - n.b. fluoroquinolones should be reserved for cases in which there is a clear indication for their use following bacteriology and/or cytology (with involvement of Gram – rods being demonstrated)
  - topical treatment is also useful
  - sometimes analgesia may be required if the patient is very painful: NSAIDS, Tramadol can be useful

- **chronic bacterial blepharitis**
  - *Staphylococcus spp.* and their toxins implicated in most cases of canine bacterial blepharitis
  - both topical and systemic treatment may be required

- **demodicosis**
  - *Demodex canis*
  - this is a cigar shaped mite with 4 pairs of short stubby legs and a long abdomen
  - long and short forms of the mite are reported
  - the entire life cycle is spent on the skin
  - transmission appears to occur from the bitch to her pups
  - predisposition: certain breeds appear to be more at risk of developing demodicosis: West Highland White Terrier, Shar Pei
  - small numbers of the mite are present in normal canine skin and hair follicles.
  - demodicosis is a skin disease caused by excessive proliferation of these mites.
  - it is unknown why in some cases this mite proliferates excessively to cause skin disease, but it is suspected that the condition is linked to an immunodeficiency
• adult dogs that develop demodicosis often have an underlying neoplastic condition, endocrinopathy and/or are receiving immunosuppressive therapy
• there are 2 forms of the disease:
• localized demodicosis
• generalised demodicosis
• the generalised disease can also be classified according to the age of onset

• localized demodicosis:
• can develop at any age, but is often seen in young animals
• most cases will spontaneously resolve without any treatment
• alopecia, erythema and scaling are most commonly seen
• NON-PRUITIC – unless secondarily infected
• face especially around the eyes are commonly affected
• rarely spreads to become generalised

• generalised demodicosis

• juvenile onset
• between 3 – 18 months old
• multiple areas of alopecia, erythema, scaling, crusting, hyperpigmentation.
• often have secondary infection

• adult onset
• over 4 years of age
• usually dog has underlying problem: neoplasia, endocrinopathy, or is receiving immunosuppressive treatment
• poor prognosis

• diagnosis
• skin scrape
• hair plucks – much easier to perform around the eyes. Mount hairs on liquid paraffin and examine under low power
• you should be able to identify eggs (lemon shaped), juvenile and adult forms of the mites
• finding one adult may not be significant

• treatment
• most are non-pruritic but bacterial infection & self-trauma may create moist, erythematous lesions, antibiotic treatment is often required

• AVOID STEROIDS! even if they are itchy
• localized demodicosis: does not usually require acaricidal treatment as they will spontaneously regress, but should be monitored closely
• generalised demodicosis
• require acaricidal treatment
• amitraz (ALUDEX) and Advocate are the only licensed products in the UK.
• treatment course is long and should be continued until 2 negative scrapes/plucks are obtained 4 weeks apart
• the animal is only classed as cured if it remains free of disease for 12 months

• dermatophytosis
• Microsporum canis is the most commonly isolated dermatophyte from dogs and cats
• in dogs other species of Dermatophyte may also be isolated. For example Trichophyton mentagrophytes and Microsporum gypseum & M.persicolor.
• highly contagious disease
• young animals are particularly at risk
• zoonosis

• clinical signs:
• areas of alopecia (often circular) +/- erythema and scale.
• folliculitis
• can be diffuse hair loss
• in cats the lesions are so variable with dermatophytosis that a fungal culture should form the baseline of any investigation for skin disease
• diagnosis
• Wood’s Lamp examination
• NB only 50% of Microsporum canis isolates will fluoresce, so it can’t be used to rule out dermatophytosis.
• false positives are often seen: topical treatments and scale will often fluoresce
• MUST SEE FLUORESCENCE OF THE HAIR SHAFT, it will be bright and apple green in colour
• the wood’s lamp must warm up for 10 minutes before the examination, otherwise it will not emit the correct frequency of light to cause fluorescence
• positive hairs can then be plucked for fungal culture

• trichogram
• arthrospores can be seen on the hair shaft under direct microscopy with some species of dermatophyte.
• arthrospores are evident under high power, to the experienced clinician.

• fungal culture
• can use the McKenzie tooth brush technique. This is especially useful for sample around the eye. Brush the affected area with a clean and unopened or sterilized toothbrush, then submit this to the lab for culture
• hair plucks for fungal culture

• treatment
• a combination of topical and systemic treatment is best.
• topical treatment will hasten resolution of clinical signs and reduce environmental contamination.
• miconazole: chlorhexidine (Malaseb®) containing shampoo is useful and licensed as an adjunctive treatment for dermatophytosis. Use with care around the eyes
• enilconazole (Imaverol®): licensed for use in dogs as a topical treatment
• systemic treatment:
• Itraconazole (Itrafungol®) is licensed for use in cats.
• no systemic anti-fungal agents are licensed for use in the dog: ketoconazole and itraconazole can be used

• Malassezia dermatitis

• Malassezia pachydermatis - most commonly isolated species from canine skin
• Malassezia is rarely seen in cats
• it is a single cell yeast with a thick cell wall
• on cytological preparations they often appear to be a snowman or peanut shape, because they are often budding
• certain breeds are predisposed to Malassezia dermatitis: Bassett hounds, WHWT, Cocker spaniels, English setters

• clinical signs: pruritus, erythema and greasy exudate on the skin, if the problem is chronic then lichenification, hyperpigmentation and alopecia may be seen
• this is a common problem affecting the ears, muzzle and is often in facial folds
• try to identify and underlying cause

• diagnosis: cytology from affected areas

• treatment: there are many licensed antifungal preparations available, but as these products may potentially damage the eye Canesten® cream is the preferred treatment option in this area
• in severe cases systemic anti-fungal therapy may need to be considered with itraconazole and ketoconazole, although currently there is no licensed systemic anti-fungal agent for dogs

• canine juvenile cellulitis

• synonyms: juvenile pyoderma, puppy strangles
• this is an uncommon granulomatous disorder affecting the face, pinnae and submandibular lymph nodes of puppies
• cause: unknown, but the response to glucorticoids, negative cultures and failure to identify causal agents on histopathology suggests an underlying immune dysfunction
• usually affects young puppies 3-16 weeks, but adult onset cases have been reported

• clinical signs: acute onset swelling of the face, especially the eyelids and muzzle
• many start with localised conjunctivitis and blepharitis
• marked submandibular lymphadenopathy
• within 48 hours the dogs develop pustules and papules on the face and especially the peri-ocular area. The lesions will then progress to fistula.
• this is a painful condition, but is not generally pruritic
• addition signs: pyrexia, anorexia, lethargy, joint pain in some cases
• lesions may also be seen on the trunk

• **diagnosis**
  - differential diagnoses include: angioedema (early stages), cutaneous adverse drug reaction, staphylococcal infection, demodicosis
  - cytology from purulent exudate reveals pyogranulomatous inflammation with no evidence of microorganisms
  - clinical signs are very suggestive
  - negative tissue culture
  - biopsy

• **treatment**
  - early and aggressive treatment is required to minimise scarring
  - immunosuppressive doses of corticosteroids prednisolone (2 mg/kg daily initially) normally at least 14 days of treatment. If the case is severe and there are trunk lesions longer courses of treatment may be required.
  - if there is cytological evidence of infection then antibiotics should also be given simultaneously.
  - this condition generally has a good prognosis although some cases will be left with scarring.

• **allergic blepharitis and conjunctivitis**
  - may be associated with cutaneous adverse food reaction or atopic dermatitis
  - difficult to determine if conjunctivitis is caused by primary allergic disease or is secondary to trauma associated with facial or eyelid pruritus
  - IgE was rarely found in tear samples from atopic dogs with suspected “allergic conjunctivitis”

• **atopic blepharitis and conjunctivitis**
  - atopy - inherited predisposition to develop a type 1 hypersensitivity (immediate) to environmental allergens
  - immediate - type 1 hypersensitivity reaction - mediated by IgE
  - allergens absorbed percutaneously and bound to epidermal Langerhan’s cells (LC’s) are APC’s- antigen presenting cells, which present allergen to T lymphocytes
  - this leads to activation of Th2 cells that secrete cytokines favouring the production of allergen specific IgE which are bound to the surface of circulating basophils and tissue mast cells.
  - When allergen crosslinks the surface bound IgE antibodies degranulation of the cells occurs with subsequent release of inflammatory mediators.
  - results in overall increased numbers of mast cells, LC’s coated with IgE and CD4+ T cells (perivascular distribution), increasing sensitivity to antigen dramatically (1000 X)

• **clinically**
  - variable severity
  - conjunctivitis - chemosis/ serous ocular discharge/ conj. follicle formation
  - blepharitis - eyelid erythema / excoriation / secondary bacteria infection with *Staphylococcus spp.* most commonly isolated

<table>
<thead>
<tr>
<th>Score for discomfort</th>
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<tbody>
<tr>
<td>Score 1. no apparent ocular discomfort</td>
<td></td>
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<tr>
<td>Score 2. occasional slight rubbing, no blepharospasm</td>
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<tr>
<td>Score 3. frequent rubbing, occasional blepharospasm</td>
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<tr>
<td>Score 4. frequent rubbing, blepharospasm, increased blink (f &gt;20/min)</td>
<td></td>
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<tr>
<td>Score 5. constant blepharospasm</td>
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• **treatment**
  - whichever the cause, topical steroids, NSAIDs and antihistamines have been used with some success when used locally whilst many dogs will improve when the skin disease is treated through the traditional means of allergen avoidance and reduction of inflammation using medication and/or allergen injection immunotherapy
• avoiding and reducing offending antigens
• desensitization (immunotherapy)
• pharmacological modification
  • the use of topical antihistamines combined with weak sympathomimetic decongestants may provide symptomatic relief
  • pheniramine/naphazoline (Naphcon-A®)
  • topical weak corticosteroids
  • prednisolone acetate 0.5% (Predsol® drops)
  • betamethasone sodium phosphate 0.1% (Betnesol® Eye Drops)
  • mast cell stabilisers
• used extensively in people for forms of allergic conjunctivitis to prevent mast cell degranulation
• mast cells not thought to play as major a role in allergic reactions in animals’ eyes
• NSAID’s
  • ketorolac – (Acular®)

**immune mediated disease**

• pemphigus foliaceus
• pemphigus erythematosus
• pemphigus vulgaris
• will cause various clinical signs including: crusting, ulceration, erosion, erythema, pustules and vesicles. The periocular region is often affected
• bullous pemphigoid
• SLE
• uveodermatological syndrome
• canine familial dermatomyositis
• medial canthal ulcerative blepharitis

• diagnosis is based on clinical signs, response to treatment, cytology and histopathology often now supported by immunohistopathology
• most reliable results are obtained if biopsies are obtained after an appropriate antibiotics to clear secondary bacterial infections – the pathology associated with chronic secondary pyoderma can complicate the interpretation of the histopathology,
• treatment is based on the use of immunosuppressive doses of steroids, azathioprine or ciclosporine

**medial canthal ulcerative blepharitis**

• breed predisposition: GSD, LH dachshund, poodle (toy and miniature)
• usually bilateral
• histopathology reveals lymphoplasmacytic infiltrates
• usually responsive to topical steroids which may be needed long term
• deep bacterial pyoderma can have a similar appearance
• histopathology (± bacteriology) – to establish if pyoderma is present
• non responsive to antibiotic therapy if medial canthal ulcerative blepharitis

**zinc responsive dermatosis**

• zinc responsive dermatosis presents as alopecia, scale, erythema in the periocular area, but the extremities can also be affected.
• there are 2 syndromes:
  – syndrome 1: occurs in northern breed dogs such as the Siberian Husky and Alaskan Malamute. in this syndrome the deficiency is a genetic defect which leads to decreased absorption of zinc from the gastrointestinal tract
  – syndrome 2: this is less common and occurs usually in large breed puppies. This is usually due to reduced zinc bioavailability. Excessive calcium supplementation in large breeds affects zinc absorption as do diets high in cereals.

• secondary skin infection is common
• treatment
• correct dietary problems if present
• zinc supplementation
• essential fatty acid supplementation.
• treat bacterial infection
Investigation & management of structural eyelid disorders

Eyelid anatomy

The eyelids are formed by two laminae. The anterior lamina consists of the skin and a muscle layer principally containing the orbicularis oculi muscle, which is responsible for eyelid closure. The posterior lamina consists of the fibrous layer, which gives the eyelid its support and the innermost conjunctiva. In people the fibrous layer is dense and referred to as the tarsal plate or tarsus. This structure is poorly developed in the dog and as such the eyelid lacks the same degree of rigid mechanical support as is evident in people. The tarsal or meibomian glands lie within the fibrous tarsus and open onto the eyelid margin at the “gray line”.

The orbicularis oculi muscle encircles the globe in concentric bands and is responsible for eyelid closure. The opening of the normal palpebral fissure is not circular but ovoid due to the lateral and medial forces on the eyelids as illustrated below. The support for the eyelids is provided by the medial and lateral canthal ligaments, orbital septum and the retractor oculi angularis muscle in the dog. The medial canthal ligament is generally well formed, providing good support for the medial canthus, and preventing excessive lateral movement. In contrast the lateral canthal stability is much more variable and often poorly supported. The lateral canthus is supported by the lateral canthal ligament and by the lateral retractor anguli oculi muscle. The lateral retractor anguli oculi muscle lies extends from the crest of the zygomatic arch to the lateral part of the orbicularis ocular muscle. Deep to this muscle the poorly formed lateral canthal ligament extends from the lateral canthus to the orbital ligament.
Entropion

Entropion is an eyelid malposition in which the eyelid margin is rolled in and subsequently contacts the ocular surface. In dogs most entropion is developmental and associated with conformational defects in purebred dogs. Given the extreme variation in the range of canine head conformations it is not surprising that the specific anatomical features leading to entropion in a particular case are so varied. Understanding the evolution of the disease is central to correcting the many variants of the disease seen in the dog.

A simplistic but useful way to consider eyelid conformation in the dog is to view the globe and eyelid as a unit in which the globe “supports” the eyelids, holding them in the correct position. The globe needs to be of the correct size and position to support the eyelids. This is particularly true for dogs in which the eyelid lacks significant internal support in the form of the well developed rigid tarsal plate. In contrast the poorly formed tarsus of the dog offers little support leaving the eyelid rather “flop-py”. It is understandable that if the globe is too small or set too far back in the orbit (enophthalmos) the eyelids will not be adequately supported. There will as a result be a tendency for the lower eyelid margin to rotate inwards over the orbital rim and contact the globe at an abnormal angle.

In dogs with normal conformation the eyelids lie “flat” against the surface on the globe with the meibomian gland openings at the leading edge of the eyelid being visible; in this situation there is no entropion. When considering the anatomical positioning (between globe and eyelids) it is evident that many clinically normal dogs have some degree of entropion. In breeds such as the Chow Chow and Shar Pei the lower eyelid is often positioned at 90 degrees to the surface of the globe. Although clinically inapparent these dogs have a 90 degree entropion.

If the globe is normal size and position then the defective anatomical positioning of the eyelid may be the result of eyelids which are too long or short, poorly supported (the medial and lateral canthal ligaments), or due to the overwhelming affects of excessive facial skin. Given the number of variables involved clinicians need a logical approach to the assessment of entropion cases. This allows the surgeon to choose corrective procedures, which address the specific factors leading to entropion in an individual patient.
The following steps are a guide with regards to the approach to an individual case.

- Globe size and the degree of exophthalmos or enophthalmos
- Eyelid length
- Lateral canthal laxity
- Relation of lateral canthus to the insertion of the lateral canthal ligament
- Effects of facial skin on eyelid position

**Globe size and degree of exophthalmos or enophthalmos**

- The average axial length of the canine globe is approximately 19 to 21 mm with B scan ultrasound. Microphthalmia may be secondary to the arrest of development of the eye at various stages of growth of the embryonic optic vesicle. Interestingly in some breeds such as collies and the Shetland sheep dog there seems to have been selection towards smaller eyes. In contrast numerous inherited microphthalmic syndromes have been described in purebred dogs. Microphthalmia in these cases is invariably associated with multiple ocular defects (MOD) which may include cataract, colobomas (lack of ocular tissues e.g. eyelid, iris and sclera), and retinal dysplasia (retinal folds/detachment). Reduction in globe size may also be acquired (phthisis bulbi) and usually is the sequel to chronic intraocular inflammation or following severe trauma.

- Enophthalmos may be primary (i.e. developmental/conformation) or follow orbital disease including… Conformational enophthalmos is often present in breeds with large broad skulls such as the mastiff breeds, St Bernard, Newfoundland and Rottweiler with large orbital spaces. The globe tends to relatively enophthalmic in these dogs, being positioned more posterior relative to the orbital rim. In some dolichocephalic breeds such as the Doberman pinscher and collies conformational entropion may also be seen. These dogs often have protrusion of the third eyelid and a “pocket syndrome” in which mucous and debris from the tear film tends to accumulate at the medial canthii, which may predispose to recurrent conjunctivitis.

- In dogs with microphthalmia or conformational enophthalmos the globe is either too small or posterior to support the eyelids properly. Although there is no specific treatment for microphthalmia or conformational enophthalmos, recognition of their contribution to entropion is important. In both instances the eyelids are poorly supported by the globe and subsequently become inverted towards the globe. Whether or not this leads to clinical problems is dependant upon the degree of inversion and whether or not eyelid cilia are secondarily contacting the cornea.

- Surgical correction in these cases involves resection of the anterior lamella of the eyelid to induce outward rotation of the eyelid margin. This is challenging to correct without exposing the ventral conjunctival sac, which may predispose to ongoing conjunctival inflammation or be considered cosmetically unacceptable by the owners.

**Surgical options:** Hotz-Celsius procedure
Eyelid length
- assess eyelid length: normal length to 33-35 mm

Surgical options:
- surgeries to shorten lids normally involve lateral canthus (less complicated – avoid lacrimal ducts / third eyelid)
  - simple wedge excision
  - Kuhnt – Szymanowsky technique- modified by blastovics: further modified by Fox and Smith – described in the dig by Munger and Carter

Lateral canthal laxity
- The medial canthus of the dog is typically firmly fixed by the medial canthal ligament to the medial bony orbital rim. This is readily appreciated by attempting to pull the lower eyelid laterally from the medial canthus; the medial canthus will normally not displace more than several millimeters laterally.
- In contrast the lateral canthal stability is much more variable and often poorly supported. The lateral canthus is supported by the lateral canthal ligament which extends from the lateral canthus to the orbital ligament and by the lateral retractor anguli oculi muscle. Without this support the opening between the eyelids (palpebral fissure) is not drawn into the normal ovoid shape

- Surgery in these cases involves creation of addition lateral canthal support.
  Surgical options:
  - Wyman’s lateral canthoplasty
  - Lateral canthoplasty with suture
Relation of lateral canthus to the insertion of the lateral canthal ligament

- Assessment should be made as to whether or not there is involution (inward rolling) of the lateral canthus.
- The lateral canthus should be visible as illustrated below

Cases of mild lateral canthal involution can easily be overlooked on cursory inspection. In such cases the presence of involution may only become fully apparent when the lateral canthus is “rolled out” so the true junction of the upper and lower eyelids can be visualized.
- When considering the pathogenesis of lateral canthal involution the direction of lateral canthal tension that is acting on the lateral canthus needs to be considered. Ideally the lateral canthus should be “pulled” in the same plane as the eyelids.

Along with conformational enophthalmos, breeds with large broad based skulls such as the Rottweiler and Golden retriever may also be predisposed to lateral canthal involution. This may be explained by the abnormal force vectors placed on the lateral canthus as examined in the anatomical studies performed by Robertson 1991
- Assessment is made by palpating the orbital ligament and assessing its relationship to the lateral canthus in the conscious patient.

Surgical options:
- Robertson’s lateral canthal tendonecmy
- Arrowhead modification of the Hotz-Celsus procedure
- Wyman’s lateral canthroplasty
- Lateral canthroplasty with suture
Assess for the presence or absence of entropion

- Close observation
- Inducible entropion

Close observation: the patient is viewed with good illumination without restraint at the start of the examination. This can be time consuming and frustrating especially in unruly or excitable patients. It is important to assess the patient with the head and neck in different degrees of flexion and extension. This is particularly important for patients with excessive loose facial skin, which may only induce entropion when the head and neck is flexed and the head down leading to the rostral sliding of the skin of the head. Having the patient on the table and viewing the eyes from below, as the head is lowers can help with this assessment. If the dog is uncomfortable local anaesthesia drops should be instilled over a few minutes to remove the “spastic” component to the entropion, allowing a more accurate assessment of the degree of anatomical entropion.
Inducible entropion: In some cases a history of intermittent ocular discomfort (blepharospasm, epiphora, facial rubbing and sometimes corneal ulceration) is present but no mechanical cause for the irritation can be identified. These are often unilateral and are associated with excessive periocular tear staining or secondary blepharitis due to chronic skin maceration and trauma. Pigmented skin at the eyelid margin may also have a whitish appearance due to hydration of the skin and depigmentation in the region of the entropion. To confirm the presence of inducible entropion the lower eyelid is pinched approximately 1 cm from the eyelid margin and gentle pulled up causing the eyelid margin to roll onto the surface of the eye. When released a normal eyelid will self correct within several blinks but patients suffering inducible entropion will not auto-correct with the eyelid remaining inwardly rolled and obvious ocular irritation. If the entropion does not correct itself within 3 to 4 blinks the entropion would be reversed by once again pinching the skin of the lower eyelid and manipulating the tissue so the eyelid margin is outwardly rolled.

General Surgery tips

1. Measure the eyelid with skin under minimal tension and mark with surgical pen. If measurements are used at surgery when skin stretched across the lid plate (i.e. eyelid skin is very elastic) this leads to inaccuracies in the assessment of the amount of skin to be excised
2. Realistic outcomes – there is a pressure or expectation that the entropion surgery should correct the defects at one surgery. This is often unrealistic as the entropion may be complex and involve multiple – needing multiple surgeries. Furthermore there may be pressure not to charge the appearance of the dog – in which the facial folds and excessive skin are primary to the pathogenesis of the problems
3. Use the simplest surgical procedure to address the factors contributing to the entropion. In reality a combination of several simple procedures will allow satisfactory outcomes in the majority of entropion cases.
4. Treat eyelid surgery as microsurgery- use magnification and appropriate instruments. Be fastidious in your attention to haemostasis, tissue handling and apposition of wounds
5. Stabilize lid with finger inserted under lid – the finger is inserted into the conjunctival sac (fornix) holding the eyelid completely taunt. Alternatively a Jaeger lid plate may be used.
6. When you do this you tend to loose your bearings i.e. where was the entropion centred? – where will my first incision be? – to overcome this let the lid go and observe it in a relaxed fashion – this is when you want to mark the eyelid to delineate your first incision e.g. for a Celsus Hotz procedure mark the incision close to the eyelid margin – make a small skin “nick” with a No. 15 blade at the ends of the proposed incision and in the middle.

Surgical procedures

Depending on the anatomical components contributing to the entropion an appropriate surgical plan can be made. Various scenarios will be considered along with the recommended surgical interventions. It will become apparent that many permutations of commonly used surgical techniques can be adapted to correct eyelid function in the vast majority of entropion cases.

Entropion secondary to microphthalmia or conformational enophthalmos

- The pathophysiological mechanisms leading to the entropion involves a lack of adequate eyelid support by a globe, which is too small or located to posterior to the eyelids.
- The globe position and size cannot be altered so correction of the entropion relies on eyelid eversion.
- The Hotz-Celsus procedure is the most commonly performed surgery for this form of entropion.
- Determining the amount of skin to be removed is critical to the success of the surgery
- Ideally this should be performed without sedation and on multiple occasions (admitting the patient the day before surgery allows multiple assessments to be made without the time restrains present during clinics)
- The following technique is recommended:
  - So dog’s head is restrained with a hand under the chin minimizing any tension on the facial skin
  - A finger is placed on the inverted eyelid 2 mm away from the surface of the eye.
  - The eyelid is then gentle everted so the eyelid margin is visible (the eyelid skin is very elastic and excessive tension during eversion will lead to stretching of the eyelid skin and subsequent over-estimation of the amount of skin which needs to be removed)
  - The distance from the finger tip to the eyelid margin is measured
  - The amount of skin to be removed will equal to this measurement minus 2 mm
• **Hotz-Celsus procedure – surgical tips**

  - Get these as close as possible to the eyelid margin (i.e., <3mm) you only need enough space between the incision and the eyelid margin to place your sutures – and these will only be between 1-2 mm from the wound margin.
  - Once these localizing nicks are made get the finger back in place so the eyelid is taut and immobile- then joint the incisions- just go through the skin – no need to take muscle. This is the critical part of surgery (most of these fail because the initial incision is too far from the eyelid margin) - the rest in more standard – use the finger under the lid to taunt it for the second incision which is elliptical and joins the ends of the first incision usually ~ 3-4 mm at widest point depending on severity of entropion.

  - Sutures – the first should be placed in middle of surgical wound. Use 6-0 Vicryl® or similar – I usually cut these flush with skin at 10 days rather than worrying too much about removal

  - Use split thickness cutaneous sutures- better apposition ~ 1-2 mm from wound edge passing through he epidermal-dermal junction

  - In dogs where you are concerned about blepharospasm post op (e.g. ulcerated painful eyes or certain breeds such as the Rottweiler then a few temporary tacking sutures which will be left in place for about a week can be very effective

  - If there is a lot of eye pain / spasm after surgery this will be still encouraging spastic changes so use topical lubricants- Viscoatears® frequently – maybe systemic NSAIDS and even a couple of doses of Ophthaine® for first 24 hrs (but no more)

  - **Clinical case:** 6 m red setter with entropion affecting the lower eyelid

    - A finger onto the lower eyelid 2 mm from the surface of the eye. The finger should be centered on the area of greatest eyelid inversion, which in this case represents the centre of the eyelids. This takes a great deal of patience as the dog’s protective reflexes will try and avoid such contact. Approaching from a ventral position will assist achieving this. This finger is held against the eyelid in this position. Note in this figure the finger appears greater than 2 mm away from the surface of the globe, which reflects the passive eversion of the eyelid due to the pressure of holding the eyelid in this position.

    - appearance following gentle eversion of the eyelid.