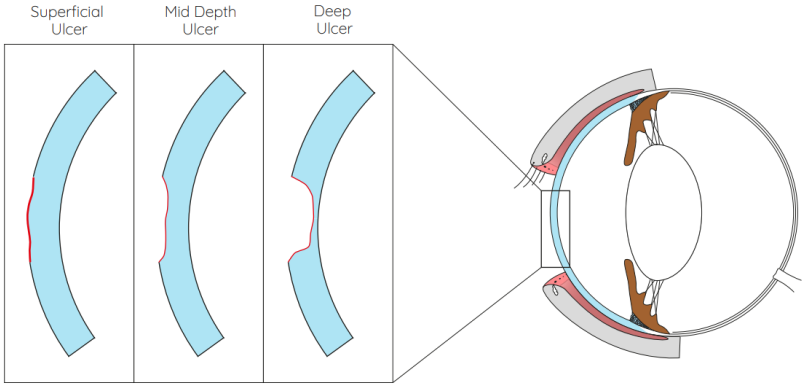
Corneal Ulcers

The cornea is the transparent layer that forms the front of the eye. The eyelids cover the cornea to protect it against trauma and spread tears over the cornea. The cornea is composed of three layers:

1. The outermost layer is called the epithelium and is 8-10 cells thick.
2. The middle layer is called the stroma and is the thickest layer, making up 90% of the cornea.
3. The inner layer is called the endothelium and is 1 cell thick, it is lined by a membrane called the Descemet's membrane that sits between the stroma and the endothelium.

What is a corneal ulcer?

A corneal ulcer is essentially a wound affecting the cornea and can be of various depths. The severity of a corneal ulcer depends on the depth and cause of the ulcer.



What causes corneal ulcers?

1. Trauma e.g. scratches from grit, thorns or claws when playing, foreign objects stuck behind the eyelids.
2. Over-exposure e.g. reduced tear production (dry eye), flat-faced breeds, facial paralysis.
3. Eyelid abnormalities e.g. extra or abnormally positioned eyelashes, inward rolling of the eyelids (entropion), outward rolling of the eyelids (ectropion), eyelid masses.
4. Infections e.g. feline herpes virus, bacteria.
5. Abnormalities of the cornea e.g. spontaneous chronic corneal epithelial defects (SCCEDs).

What are the signs of corneal ulcers?

- Excessive tear production
- White, green or yellow eye discharge
- Increased blinking or squinting
- Rubbing the eyes
- Red eyes
- Blue or hazy cornea

How are corneal ulcers diagnosed?

Ulcers are diagnosed following examination of the eyes. Mid depth or deep ulcers may be visible with the naked eye, but it is often necessary to use a dye called fluorescein to highlight the ulceration. Fluorescein sticks to ulcers and stains them bright green, so they are visible. As part of the examination, we will also check for underlying causes and complications associated with the ulcer.

How are simple ulcers treated?
Simple ulcers involve loss of the outermost layer of the cornea only (superficial ulcers) and have no underlying cause (they are usually related to trauma). These ulcers should heal with medical management within 7 days.

Treatment involves:

- Broad-spectrum antibiotic eye drops or ointment applied 2-4x daily to prevent infection of the ulcer.
- Lubricating eye drops applied 2-4x daily to improve comfort levels and prevent the ulcer drying out.
- Pain-relief by mouth or with food.
- An Elizabethan collar to prevent rubbing and further trauma to the eye.

These ulcers should be rechecked after 2-3 days to ensure they are healing properly as several complications can result from a corneal ulcer. Any complications affecting the eye should be addressed promptly to reduce the risk of permanent damage.

What are the potential complications of corneal ulcers?
Mid-depth ulcers
If an ulcer involves loss of part of the middle stromal layer, more intensive medical treatment is required to ensure the ulcer heals.

Treatment involves:

- Broad-spectrum antibiotic eye drops or ointment applied 6-8x daily to prevent infection of the ulcer.
- Lubricating eye drops applied 6-8x daily to improve comfort levels and prevent the ulcer drying out.
- Pain-relief by mouth or with food.
- An Elizabethan collar to prevent rubbing and further trauma to the eye.

Deep ulcers
If >50% of the middle stomal layer is lost, the cornea becomes fragile and there is a risk the eye may rupture (corneal perforation). For these cases, surgical treatment is recommended. The aim of surgery is to fill the wound, promote healing and stabilise the cornea. The most common procedures involve grafting techniques, using the patient's own cornea and/or conjunctiva (lining of the eyelids) or artificial grafts. The grafts are stitched over the ulcer to fill the wound and are secured with dissolvable stitches. This will result in scarring of the cornea which may impact vision, but the grafting techniques allow your pet to retain a comfortable eye with reasonable vision, and it reduces the risk of corneal perforation. This requires specialist equipment and microsurgical skills, so these patients need to be referred to an ophthalmologist.

Even though surgery is often the preferred option, this does not mean that deep ulcers cannot heal with medical management alone. In cases where surgery is not possible, we can try intensive medical management, however there is a risk of corneal perforation, and this may ultimately require removal of the eye.

These ulcers should be re-examined after 24 hours because of the risk of corneal perforation.

Descemetocele
An ulcer is called a descemetocele when the wound has eroded through the middle stromal layer to the very fragile, thin layer known as the Descemet's membrane that lines the endothelium. These are surgical emergencies as the eye is at high risk of rupture. Surgical options involve referral to an ophthalmologist for a grafting procedure. As with deep ulcers, even though surgery is the preferred option, a descemetocele may heal with intensive medical management, but close monitoring is required.

Infection

If ulcers become infected there is a risk of keratomalacia or "melting" of the cornea. This occurs when bacteria inside the ulcer produce enzymes called collagenases that break down collagen. Collagen normally maintains the solid structure of the cornea; destruction of collagen results in a soft, weak, jelly-like cornea. This can rapidly progress to rupture of the eye (corneal perforation) within 24 hours so is considered an emergency.

Melting ulcers have a characteristic cloudy and jelly-like appearance. A swab of the cornea is often performed to identify the bacteria involved and guide treatment.

Treatment involves:

- Intensive medical management
    - Antibiotic eye drops and antibiotic tablets to treat the infection. Antibiotic eye drops need to be applied every 1-2 hours for the first 48 hours then the frequency may be reduced if the cornea is improving. Antibiotic tablets are given by mouth or with food.
    - Anti-collagenase eye drops to prevent the collagenases from breaking down collagen. Anti-collagenase eye drops need to be applied every 1-2 hours for the first 48 hours then the frequency may be reduced if the cornea is improving.
    - Pain-relief by mouth or with food.
    - An Elizabethan collar is used to prevent rubbing and further trauma to the eye.
- Corneal cross-linking – this is a procedure performed under anaesthetic to kill any bacteria and stabilise the collage to prevent further melting. This is performed by a specialist and requires referral to an ophthalmologist.
- Corneal surgery using grafting techniques if the ulcer becomes a deep ulcer. This is performed by a specialist and requires referral to an ophthalmologist.

These ulcers should be re-examined after 24 hours because of the risk of corneal perforation.

Spontaneous chronic corneal epithelial defects (SCCEDs) or indolent ulcers

A SCCED occurs in older dogs who have a genetic abnormality affecting the cornea. This results in a hyaline membrane forming between the epithelium and stoma, which stops the outer epithelial cells from linking to the underlying stroma as they attempt to spread across the ulcer to repair it. As a result, the ulcer may appear to heal, but because the new cells are not fixed in place, the repair is fragile, and the cells are disturbed and removed as the dog blinks.

Treatment involves:

- Removal of the abnormal tissue to encourage normal healing. There are several methods that vary in intensity and success rate.
    - Cotton bud debridement - a cotton bud is rubbed across the surface of the eye to remove the loose epithelium. This can often be performed in a consultation after the application of a local anaesthetic eye drop. The success rate is 60%.
    - Diamond burr debridement - cotton bud debridement is performed followed by a minor surgical procedure known as a keratotomy. This involves use of a diamond burr that is rubbed over the surface of the cornea to puncture the hyaline membrane and expose the stroma for the epithelial cells to fix to. This usually requires injectable sedation alongside the application of a local anaesthetic eye drop to perform. A contact lens is placed over the cornea following the procedure to act as a bandage. The success rate is 75% with healing occurring within 1-2 weeks.
    - Surgical debridement - this is performed under general anaesthetic and involves completely removing the loose epithelium, hyaline membrane and part of the stroma with a surgical cut. It is a specialist surgery that requires referral to an ophthalmologist. The success rate is 99%. This procedure is usually reserved for difficult cases that fail to heal following diamond burr debridement.

- Broad-spectrum antibiotic eye drops or ointment to prevent infection of the ulcer.
- Lubricating eye drops to improve comfort levels and prevent the ulcer drying out.
- Pain-relief by mouth or with food.
- An Elizabethan collar to prevent rubbing and further trauma to the eye.

Uveitis

Sometimes corneal ulceration can cause inflammation within the eye, known as uveitis. This is a painful spasm of the iris that causes constriction of the pupil (so the pupil will be smaller in the damaged eye compared to the normal eye).

Treatment involves the use of an eye drop called atropine that dilates the pupil (often causing the pupil to become much larger than the normal eye). Often a single application is all that is required as the effects can last up to 7 days, but sometimes additional doses are needed, and we will assess this at the recheck appointment. It is not uncommon for dogs and cats to salivate a lot after having atropine drops applied because they do have a bitter taste.

What does a healing corneal ulcer look like?

Normally, the cornea is transparent and does not contain any blood vessels. As an ulcer heals, a border of red blood vessels can be seen developing from the edge of the cornea that move across the cornea towards the ulcer. The blood vessels bring oxygen and essential nutrients to help the ulcer heal. It can be quite concerning to see the cornea turning red, but actually this is a sign of healing. Once the ulcer has healed, the blood vessels will fade away, but it is common for a white scar to remain in the region of the ulcer. The scarring may improve with time but is unlikely to completely resolve.

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