

# **REPTILIAN OPHTHALMOLOGY**

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**Abstract:** This paper presents a guide to reptilian ophthalmology, covering the approach to assessing, investigating, recording, and diagnosing ophthalmic conditions in reptiles.

**Key words:** ophthalmology, reptile.

## **INTRODUCTION**

The general approach to the ophthalmoscopic examination of reptiles should not differ in any way from that performed in domestic species. Many ocular conditions are common to all species. Ophthalmology should be an essential part of the clinical examination of all reptiles. Jackson in 1981 stated that little use appears to have been made of the ophthalmoscope in reptiles, a statement that is probably still true today. The basic ophthalmic instrumentation used for dogs and cats can be easily adapted for the examination of reptiles.

## **MATERIALS AND METHODS**

### **Approach to the Ophthalmic Examination**

The general approach to the ophthalmological examination of reptiles should differ in no way from that performed in mammals or birds and has now been widely mentioned (Lawton, 1992; Lawton, 1997; Lawton, 1998a). Any veterinarian that is competent in the handling and restraint of reptiles will be able to perform a full ophthalmic examination. It is useful to have a nurse/technician restrain the reptile so that the veterinarian's hands will be free to operate the ophthalmic instruments. In aggressive or venomous species, anesthesia is recommended.

It is advantageous to know what a normal eye and adnexa of the species being examined should look like. To this extent, examination of the normal eye should always be undertaken first. Although there are conditions which can effect both eyes, it is more usual for only one eye to be affected. A thorough examination of the more normal eye will allow a better assessment of the affected eye.

In general, the reptilian eye is very similar to that of mammals, although there are differences. The iridocorneal angle has some similarities to that of mammals although it is less well developed (Millichamp, *et al*, 1983). There is no Descemet's membrane of the cornea (Duke-Elder, 1958) and the retina is avascular (anangiotic). One of the major anatomical differences is the presence of ossicles in the sclera, which maintain the shape and size of the eye.

Before any ophthalmic instrumentation is used, assess the shape and position of the eye. A mass (particularly an abscess) may alter the position of the eye. A prolapsed nictitans (in species where this is present) may indicate a slight exophthalmous associated with a retrobulbar mass. Testing the menace response can be attempted, but lack of response may not indicate blindness. The light responses should only be tested in a darkened room with a good light source. Although direct light response is rapid, a consensual light reflex cannot be elicited (Millichamp, *et al*, 1983) and should not be confused with a neurological deficit.

Although the majority of ophthalmic examinations can be completed without mydriasis, it is useful to allow the examination of the whole of the lens and fundus. Mydriatics, however, tend not to work successfully due to striated musculature in the reptilian iris which is under voluntary control (Walls, 1942). Mydriasis is best achieved under general anaesthesia, although Millichamp and Jacobson (1986) advised the use of D-tubocurarine in larger species of lizards or crocodilians. The tubocurarine (0.05-1.0ml) is injected via a 27-30ga needle into the anterior chamber, giving mydriasis from 30min to several hours.

### **Ophthalmic Instrumentation**

Direct ophthalmoscopy is the most frequent method of ophthalmic examination, although this is not the best method, particularly with reptiles. Direct ophthalmoscopy should be used as a screening process; when a suspected abnormality is noted or suspected indirect ophthalmoscopy should be used.

Although indirect ophthalmoscopy is associated with more expensive equipment, this need not be the case. The only essential equipment for performing indirect ophthalmoscopy is a condensing lens and a light source. All the advantages of indirect ophthalmoscopy described by Slatter (1981) are just as true for reptiles as they are for any other animals, i.e., large area of fundus may be examined at any one time, although this image is upside down and inverted. The use of indirect ophthalmoscopy also allows assessment of 3-dimensions and, therefore, better illuminates lesions of the anterior segment, lens, fundus, and vitreous, even the conus papillaris in lizards. The use of indirect ophthalmoscopy has the advantage of keeping the animal's head (and mouth) at arm's length from the veterinary surgeon's face. The lens should be either 30 diopter (for the larger species) or 90 diopter (for a very small eye).

Some degree of magnification, ideally a slit lamp or a plus 10 or 15 lens on an ophthalmoscope, is also advised for the examination of the adnexa, cornea, and anterior segment. This is especially useful when dealing with the smaller species where, without magnification, lesions would be missed.

### **Ophthalmic Further Investigation**

Any suggestion of reduced tear film or evidence of keratitis should be examined further by measuring the tear film. Schirmer tear tests can be used in reptiles with eyelids, providing they are pre-cut to a suitable size.

Cytology and bacterial culture and sensitivity should always be used to further investigate any suggestion of infection.

If there is a suspicion of damage to the cornea or interference with the nasolacrimal apparatus, then the use of fluorescein dye will help to establish the degree of the problem. Rose Bengal can also be used when there is evidence of keratitis.

## Ophthalmic Anatomy

Usually the reptilian globe is almost spherical. Scleral ossicles, between 6-17, (absent in the ophidian eye) play an important part in accommodation in reptiles by changing the shape of the eye itself and therefore altering the distance between the cornea and fundus (Walls, 1942). The snake achieves accommodation by changes in lenticular shape and pressure changes within the eye resulting in movement of the lens forwards and backwards (Davies, 1981). There is little movement of the eye except in chameleons.

The eyelids of snakes, some geckos, and the skink (*Ablepharus* spp.) have fused with no palpebral fissure. The fused eyelids form a transparent membrane known as the spectacle, brille, or eyecap. Walls (1942) described 3 types of spectacles. The type found in snakes and lizards (Order Squamata) is the tertiary spectacle which embryologically is mainly derived from the lower eyelid. Although it is a horny, dry, transparent eyescale, Millichamp, *et al*, (1983) using microsilicone injection showed it to be highly vascular, although in cases of inflammation this can be easily seen under magnification (Lawton, 1998b). Crocodilians, like humans, have a well developed tarsal plate (Millichamp and Jacobson, 1986) although this may often become ossified (Dupont and Murphy, 1998).

The reptilian cornea is thin. There is no Bowman's layer although the Descemet's membrane is present in all but a few geckos (Duke-Elder, 1958).

Reptiles, have an anangiotic retina containing both rods and cones. Chelonia rely solely on choroidal blood vessels. In lizards, there are modified vessels protruding into the vitreous known as the conus papilaris. In snakes there is a vascular network overlying the retina known as the membrana vasculosa retinae. In adult crocodilians, the conus papilaris is functionless and is reduced to a glial pad with one or two capillaries (Walls, 1942; Duke-Elder, 1958). Crocodilians have a tapetum formed by guanine crystals which is hyperelective.

In Sauria (lizards) and Rhynchocephalia (*Sphenodon punctatus*), there is a parietal eye (third eye), which is the remnant of the median eye which was originally a paired visual organ on the roof of the head of provertebrates (Walls, 1942). Histologically, this is shown to have a neurological input and to contain a primitive retina and in the case of the tuatara (*Sphenodon punctatus*) also a lens. The third eye is located in a hole below the parietal bone, and in the tuatara the overlying scales are transparent. There is a relationship between the parietal eye, the pineal body, and the habenular nucleus; and the parietal eye is thought to play a role in hormone production and thermoregulation.

## Ophthalmic Conditions Seen

Of the congenital abnormalities, microphthalmia is the most common especially in snakes (Dupont and Murphy, 1998). Microphthalmia can often be mistaken for anophthalmia (which is very rare) unless histopathology is undertaken (Lawton, 1999).

Eyelids are prone to trauma in all species. Frye (1972) described damage to the eyelids as a result of heat lamp burns and outlined a blepharoplasty technique for repair. Trauma to the spectacle of snakes, especially avulsion, is serious, as it may result in corneal desiccation due to a lack of continuity of the tear film and may ultimately result in loss of the eye (Lawton, 1998b; Lawton, 1999). Treatment may be attempted by using topical antibiotics and artificial tears, a cut-down soft contact lens, or by transposing oral mucosa over the eye. Some success has recently been achieved by using Biosists a collagen graft material. Neoplasia of the eyelids has been reported in a number of species, and in each case involves a virus.

Retained spectacle is the most common ocular problem of snakes. It arises because of a failure of the old spectacle to shed during ecdysis (Lawton, 1992; Lawton, 1998b; Lawton, 1999). The retained spectacles may become secondarily infected resulting in permanent blindness. Treatment involves soaking the retained spectacle to aid its removal, some times with artificial tears (hypromellose). This is best done using a wet cotton bud and rubbing from the medial and lateral canthi towards the center of the spectacle. Although Frye (1981) advises the use of forceps or other instruments to remove a retained spectacle, this author considers these techniques ill advised and liable to result in damage to, or even avulsion of, the underlying spectacle unless undertaken by the very experienced.

The tear film in reptiles can often be compromised especially by vitamin A deficiency (Elkan and Zwart, 1967). The deficiency also causes conjunctival and corneal epithelial metaplasia and hyperkeratosis. Changes are reversible depending on the length of time for which the deficiency has existed. Definitive diagnosis of "dry eye" is made using cut down Schirmer tear test strips. Treatment is similar to that employed in mammals, using artificial tear preparations. When xerophthalmia is present, administration of vitamin A on a weekly basis is advised (Lawton, 1997).

Some species of tortoises (*Testudo* spp.) lack a functional nasolacrimal system (Lawton, 1997) and tears naturally spill over the eyelids. In snakes, blockage of the nasolacrimal system can result in the accumulation of tears between the cornea and spectacle and an enlargement of the subspectacular space (Lawton, 1992). This is differentiated from subspectacular abscesses in that the fluid is clear. Patency of the snake's nasolacrimal drainage system may be investigated by injecting a small amount of fluorescein through the lateral canthus of the spectacle into the subspectacular space and then examining the oral cavity for signs of fluorescein drainage (Lawton, 1999).

Conjunctivitis is a common problem in all reptiles. The absence of lysosomes in heterophils usually results in caseous plaques which are often retained within the conjunctival fornix. The presence of these plaques can cause a foreign body reaction. Reptiles, other than snakes, presenting with closed eyes, should have their conjunctival fornix flushed with Hartmann's solution via a fine soft cannula (24g) or explored using wetted endodontic paper points in order to remove any caseous plaques. Antibiotics, such as ciprofloxacin, usually control the infection (Lawton, 1997). Vitamin A deficiency will also cause caseous masses in the conjunctival fornix of a similar appearance to those found in cases of conjunctivitis.

Conjunctivitis in snakes presents as a subspectacular abscess (Lawton, 1999). The spectacle appears cloudy or white and may be distorted. These cases often result from stomatitis and ascending infection of the nasolacrimal duct, although hematogenous spread of systemic infection may occur. The condition may be unilateral or bilateral. Treatment involves cutting a small wedge through the spectacle at the lateral canthus (a swab should be taken for culture and sensitivity), and flushing the subspectacular space with Hartmann's solution on a daily basis. A suitable ophthalmic solution such as ciprofloxacin or gentamicin is applied after flushing. Depending on the culture and sensitivity results, systemic antibiotic treatment may also be required.

Keratitis in tortoises (*Testudo* spp.) is seen as a white corneal mass (Lawton, 1997). Such keratitis is contagious and should be considered a herd problem. Treatment consists of removal of the plaque from the cornea under general anaesthesia. Samples should be sent for culture and sensitivity. Topical treatment using a suitable antibiotic such as ciprofloxacin usually cures any infection.

Corneal ulceration may be associated with foreign bodies or trauma as in other species. Traumatic lacerations can be sutured with a fine suture material (8/0 or 10/0 "Mersilene", Ethicon) and a course of topical antibiotic provided. Severe ulcerations in chelonians and lizards may be treated by performing a third eyelid flap.

Uveitis may result from trauma, infection (bacteria, fungi, virus), or be associated with neoplasia. The clinical signs and treatment are similar to those in mammals. Hyphema and hypopyon are often present following exposure to freezing temperatures (Lawton, 1989).

Cataracts in tortoises (*Testudo* spp.) have been associated with freezing episodes (Lawton, 1989; Lawton and Stoakes, 1989). Duke-Elder (1958) reported that the chelonian lenses are extremely soft and almost fluid like in consistency. It is hypothesised that because of this they are particularly prone to damage from low temperatures. In some cases these changes are reversible, although it may take up to 18mo for the lens to clear (Lawton and Stoakes, 1989). Cataract surgery in reptiles can be performed in a similar manner to that already described for birds.

Retinal damage has been reported in cases of vitamin A deficiency and following freezing episodes in tortoises (*Testudo* spp.) (Lawton and Stoakes, 1989). In certain circumstances, treatment with vitamin A may result in clinical improvement. Retinal degeneration has been reported in tokay geckos, *Gekko gecko*, (Schmidt and Toft, 1981; Bonney, *et al*, 1978) although it is also thought to be a sporadic finding in most reptile families (Millichamp and Jacobson, 1986).

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