

CATARACT

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A cataract is an opacity of a structure inside the eye called the lens. The lens is oval in cross section and is found behind the iris and in front of the vitreous. It is made up of living cells which replicate themselves from early embryonic life and continue to do so for the whole of an animal's life. The lens is usually clear and transparent, and was developed in evolution as a means of bringing into focus on the retina (the light detecting membrane at the back of the eye) structures close to the eye. The same process happens inside a traditional SLR camera, with the lens focusing an image onto the film in the back of the camera. In younger animals the lens has the ability to change shape to accommodate so that the eye can focus on objects at near or far distance. This ability to accommodate is lost with age as the lens becomes harder and less able to change shape. For descriptive purposes the lens can be thought of as having an onion like or layered structure. The central and oldest part of the lens is called the nucleus, around this is the epinucleus ("epi" means around) then the outer part is referred to as the cortex. The front and back of the lens in the middle of the eye are referred to as the poles of the lens. The edge of the lens is called the equator. Finally completely surrounding the whole lens is the capsule.

The lens cells can become sick with changes to the chemical structure of the lens proteins (called crystallins) in these cells. When this happens the lens becomes cloudy and the opaque lens is referred to as a cataract. In humans, cataracts are one of the most common causes of blindness, especially in third-world countries. Contrary to popular misunderstanding a cataract is **not** a growth or film over the surface of the eye, it actually occurs right inside the eye!

Currently the only treatment for cataracts in man or beast is surgical removal. Generally removal is performed through a tiny "key-hole" incision (generally 2.5-3mm wide) in the top of the eye by a process called phacoemulsification, where high frequency ultrasound energy is used to shatter the lens to pieces and suck the emulsified lens out through the small incision. Because the lens is inside and not over the eye the cataracts cannot be simply "scraped off"! After the cataract is removed a tiny plastic artificial replacement lens is rolled up inside a small tube and injected into the eye through the small incision. This lens then unfolds inside the lens capsule and restores normal focused close up vision. There have been some recent controversial claims that certain drugs eg amino acid supplements such as L-carnitine will cure cataracts but the evidence that these drugs will actually make a mature cataract resolve are very dubious.

Cataracts can be classified in different ways. Examples of classification criteria include:

Age of onset: eg congenital (present at birth), juvenile (young dogs), senile (old dogs)

Part of the lens affected: eg anterior cortical, posterior cortical, nuclear, epinuclear, suture line (along lines in the back and front of the lens where the lens cells meet each other from opposite sides), equatorial or polar.

Cause of the cataract eg diabetic cataract, nutritional cataract, genetic cataract, age related cataract

Degree of development of the cataract (attempts to describe how much of the lens is affected): eg incipient (almost not there), immature, mature, hypermature

Many things can cause cataracts, and often we cannot be 100% certain of the cause in each and every case. Many cataracts seen in dogs are thought to be genetic, but diabetes, traumatic injuries, inflammation, drugs and nutrition may also be to blame. So called steroid ("cortisone") induced

cataracts are seen in man but have not been suspected in dogs. There are a number of well known genetic cataracts in laboratory animals such as rats where the outcome of breeding specific individuals together is highly predictable. Many cataracts in different pure breed dogs are suspected to have an underlying genetic basis but this is not as yet proven. At the time of writing (mid 2007) the genetic cause of cataract has only been identified in three breeds: the Staffordshire Bull Terrier, the Boston Terrier and the French Bulldog. There are actual DNA tests (developed by molecular biologists at the Animal Health Trust in Newmarket UK) for the specific gene mutation known to cause the cataract in these breeds. In other breeds our general approach is to assume a cataract to be hereditary unless another specific cause is identified eg trauma, unrelated intraocular inflammation or specific metabolic diseases such as diabetes. In general cataracts which affect one eye only in an individual are less likely to be genetic and are more likely to be due to local influences on that eye only eg trauma

Juvenile cataracts are usually seen for the first time in young dogs (usually less than 3 years of age) and are seen in a number of breeds. These cataracts usually mature early and cause blindness. These cataracts are strongly suspected to be heritable in most breeds in which they occur.

Another type of cataract seen in young dogs is the **nuclear cataract**: this type of cataract is seen in the nucleus or the centre of the lens which is the earliest part of the lens to form embryologically so these cataracts are often congenital ie present from birth. These cataracts may sometimes reflect an insult during embryonic development and may not necessarily be heritable in all breeds. They are often accompanied by other ocular abnormalities as well (see below with respect to the Miniature Schnauzer)

In the Miniature Schnauzer two distinct morphological types of cataract have been described and both are thought to be inherited as a simple autosomal recessive trait ie the cataracts will only be seen in offspring which have inherited one recessive gene from both parents.

- (1) Congenital cataracts involve the nucleus and to a lesser degree the posterior cortex and progression seems to be variable. Often other ocular abnormalities such as microphthalmos (small eyeball), microphakia (small lens) and lenticonus (abnormal protrusion of the back of the lens into the vitreous cavity) are seen with the occurrence of the cataract.
- (2) Juvenile cataract can first be seen in puppies at several weeks of age and primarily involves the posterior lens cortex. ie the back part of the lens. These cataracts usually develop to maturity eventually causing complete blindness over 2-3 years. Recently we have seen these cataracts appear at an older age after not being noticed at a puppy exam in this breed. These probably represent a newer variant of the same genetic disease.

Unfortunately unless molecular biologists eventually identify the actual gene mutation causing cataract in your breed, we can still only speculate about heritability. This is why eye certification by a competent veterinary ophthalmologist is still important in identifying affected dogs. Then pedigree studies can be performed to see if the incidence of cataract in different generations of related dogs supports the theory for the mode of inheritance. Test matings with examination of progeny for the condition can also be performed in an attempt to test the hypothesis of the mode of inheritance. We may well find one day that the same gene mutation is responsible for the occurrence of cataracts in a number of breeds including the Mini Schnauzer. If the gene is identified then carriers and affected dogs will be able to be identified from a young age by simple DNA testing, enabling breeding with more predictable results.