

**Ocular disorders**

	Diagnosis	Description and comments specific to the breeds	Inheritance	Gene/marker test	References
A	Myopia	Affects up to 40% of dogs; mean refractive error of myopic schnauzers is -1.4D	Unknown	None	1, 2
B	KCS	RR=1.8; low meibum production may predispose to KCS	Unknown	None	3-6
C	Congenital cataract with posterior lenticonus and microphthalmia	Cataracts are in the nucleus & posterior cortex; globe and lens size reduced 10-20%; lenticonus in 20% of cataracts	Presumed autosomal recessive	None	7-12
D	Juvenile Cataract	Age of onset 6+ months; posterior cortex	Autosomal recessive	None	13-14
E	Photoreceptor dysplasia	Behavioral and funduscopic changes typically appear at 2-5 years of age; ERG and histopathological changes may be seen as early as 8 weeks	Autosomal recessive	None	15-16
F	Ceroid lipofuscinosis	Loss of vision and neurological signs due to retinal and cortical degeneration	Presumed autosomal recessive	None	17-19
G	Progressive retinal atrophy		Partially dominant	YES	20
H	Retinal dysplasia with or without PHPV	Generalized dysplasia, with retinal detachment and/or PHPV in 50% of affected dogs	Autosomal recessive	None	21-22

The ECVO's advice relating to hereditary eye disease control

A	Myopia	OPTIONAL
B	KCS	OPTIONAL
C	Congenital cataract with posterior lenticonus and microphthalmia	NO BREEDING from the affected animal
D	Juvenile Cataract	NO BREEDING from the affected animal
E	Photoreceptor dysplasia	NO BREEDING from the affected animal, its parents or offspring
F	Ceroid lipofuscinosis	NO BREEDING from the affected animal, its parents or offspring
G	Progressive rétinal atrophy	NO BREEDING from the affected animal, its parents or offspring
H	Retinal dysplasia with or without PHPV	NO BREEDING from the affected animal, its parents or offspring

Recommendations regarding age and frequency for eye examinations

As for all other breeds (see part 7)

References

1. Murphy CJ, Zadnik K, Mannis MJ. Myopia and refractive error in dogs. *Invest Ophthalmol Vis Sci*. 1992;33(8):2459-63.
2. Kubai MA, Bentley E, Miller PE, Mutti DO, Murphy CJ. Refractive states of eyes and association between ametropia and breed in dogs. *Am J Vet Res*. 2008;69(7):946-51.
3. Kaswan RL, Salisbury MA. A new perspective on canine keratoconjunctivitis sicca. Treatment with ophthalmic cyclosporine. *Vet Clin No Am: Sm Anim Prac* 1990;20:583–613.
4. Helper LC. The tear film in the dog. Causes and treatment of diseases associated with overproduction and underproduction of tears. *Anim Eye Res* 1996;15, 5–11.
5. Moore CP. Diseases and surgery of the lacrimal secretory system. In: Gelatt, K.N. (Ed.), *Veterinary Ophthalmology*, 1999 (Third ed). Lippincott Williams & Wilkins, Philadelphia PA, USA, pp. 583–607
6. Ofri R, Orgad K, Dickstein S. Canine meibometry: Establishing baseline values for meibomian gland secretions in dogs. *Vet J* 2007;174:536-40.
7. Gelatt KN, Samuelson DA, Barrie KP, Das ND, Wolf ED, Bauer JE, Andresen TL. Biometry and clinical characteristics of congenital cataracts and microphthalmia in the Miniature Schnauzer. *J Am Vet Med Assoc*. 1983;183(1):99-102.
8. Daniel WJ, Noonan NE, Gelatt KN. Isolation and characterization of the crystallins of the normal and cataractous canine lens. *Curr Eye Res*. 1984;3(7):911-22.
9. Monaco M, Damuelson DA, Gelatt KN. Morphology and postnatal development of the normal lens in the dog and congenital cataract in the Miniature Schnauzer. *Lens Res* 1984;2:393-400.
10. Barnett KC. Hereditary cataract in the Miniature Schnauzer. *J Sm Anim Pract* 1985;26:635-644.
11. Zhang RL, Samuelson DA, Zhang ZG, Reddy VN, Shastry BS. Analysis of eye lens-specific genes in congenital hereditary cataracts and microphthalmia of the miniature schnauzer dog. *Invest Ophthalmol Vis Sci*. 1991;32(9):2662-5.
12. Shastry BS, Reddy VN. Studies on congenital hereditary cataract and microphthalmia of the miniature schnauzer dog. *Biochem Biophys Res Commun*. 1994;203(3):1663-7.
13. Rubin LF, Koch SA, Hubert RJ. Hereditary cataracts in miniature schnauzers. *J Am Vet Med Assoc* 1969;154:1456-58.
14. Barnett KC. Hereditary cataract in the dog. *J Sm Anim Pract* 1978;19:109-120.
15. Parshall C, Wyman M, Nitroy S, Acland GM, Aguirre GD. Photoreceptor dysplasia: an inherited progressive retinal atrophy of miniature schnauzer dogs. *Prog Vet Comp Ophththalmol* 1991;1:187-203.
16. Zhang Q, Baldwin VJ, Acland GM, Parshall CJ, Haskel J, Aguirre GD, Ray K. Photoreceptor dysplasia (pd) in miniature schnauzer dogs: evaluation of candidate genes by molecular genetic analysis. *J Hered*. 1999;90(1):57-61.

17. Smith RIE, Sutton RH, Jolly RD *et al.* A retinal degeneration associated with ceroid-lipofuscinosis in adult miniature Schnauzers. *Prog Vet Comp Ophthalmol* 1996; **6**: 187–191.
18. Jolly RD, Sutton RH, Smith RI, Palmer DN. Ceroid-lipofuscinosis in miniature Schnauzer dogs. *Aust Vet J.* 1997;75(1):67.
19. Palmer DN, Tyynelä J, van Mil HC, Westlake VJ, Jolly RD. Accumulation of sphingolipid activator proteins (SAPs) A and D in granular osmiophilic deposits in miniature Schnauzer dogs with ceroid-lipofuscinosis. *J Inheri Met Dis* 1997; **20**: 74–84
20. Jeong M, Han CH, Narfström K, Awano T, Johnson GS, Min MS, Seong JK, Sep KM: A phosphatidylcholine transferase (PDC) mutation does not cause progressive retinal atrophy in Korean miniature schnauzers. *Anim Genet*, 39(4):455-456, 2008.
21. Grahn BH, Storey ES, McMillan C. Inherited retinal dysplasia and persistent hyperplastic primary vitreous in Miniature Schnauzer dogs. *Vet Ophthalmol.* 2004;7(3):151-8
22. Appleyard GD, Forsyth GW, Kiehlbauch LM, Sigfrid KN, Hanik HL, Quon A, Loewen ME, Grahn BH. Differential mitochondrial DNA and gene expression in inherited retinal dysplasia in miniature Schnauzer dogs. *Invest Ophthalmol Vis Sci.* 2006;47(5):1810-6.