

Miniature Schnauzer		
----------------------------	--	--

Ocular disorders known or presumed to be inherited (published)

	Diagnosis	Description and comments specific to the breed	Inheritance	Gene/ marker test	References
A	Myopia	Affects up to 40% of dogs; mean refractive error of myopic schnauzers is -1.4D	Unknown	NO	1, 2
B	Keratoconjunctivitis Sicca	Relative risk = 1.8; low meibomian gland production may predispose to KCS	Unknown	NO	3-6
C	Cataract	1. Congenital with posterior lenticonus and microphthalmia: Nucleus and posterior cortex; globe and lens size reduced 10-20%; lenticonus in 20% of cataracts 2. Juvenile posterior cortex: Age of onset 6+ months	1. Presumed autosomal recessive 2. Autosomal recessive	NO	7-12 13,14
D	Ceroid lipofuscinosis	Loss of vision and neurological signs	Presumed autosomal recessive	NO	17-19

	Progressive Retinal Atrophy (PRA)	1. PRA Type A, (Photo receptor dysplasia), uncommon. ERG and histopathological changes from 8 weeks. Funduscopic changes and visual impairment appear at 2-5 y.o.; 2. PRA Type B/B1; Early 2-4 y.o 3. Late-onset form	1. Presumed Autosomal recessive 2. Autosomal recessive 3. Unknown	Type A-PRA PPT1/HI VEP3	15,16,20, 23,24
F	Retinal dysplasia with or without PHPV	Generalized dysplasia, with retinal detachment and/or PHPV in 50% of affected dogs	Autosomal recessive	NO	21,22

The ECVO's advice relating to hereditary eye disease control

Please see ECVO Manual chapter 8: VET Advice

Recommendations regarding age and frequency for eye examinations

Please see ECVO Manual chapter 7: ECVO Age and Frequency recommendations

Other ocular disorders (reported)

	Diagnosis	Source
A	Microphtalmia	ACVO genetics committee
B	Distichiasis	ACVO genetics committee Finnish Kennel Club Database
C	Persistent pupillary membranes	ACVO genetics committee
D	Corneal dystrophy -epithelial/stromal	ACVO genetics committee
E	Vitreous degeneration	ACVO genetics committee

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 Pract 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 Ophththalmol* 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 phosducin gene (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.
23. Murgiano L, Becker D, Torjman D, Niggel JK, Milano A et al. Complex Structural PPT1 Variant Associated with Non-syndromic Canine Retinal Degeneration. *G3* doi.org/10.1534/g3.118.200859, 2019.
24. Kaukonen M, Quintero IB, Mukarram AK, Hytonen MK et al. A putative silencer variant in a spontaneous canine model of retinitis pigmentosa. *PLOS Genet* 16(3):e1008659, 2020