



Ocular disorders known or presumed to be inherited (published)

	Diagnosis	Description and comments specific to the breed	Inheritance	Gene/ marker test	References
A	Microphthalmos and multiple ocular anomalies	Associated with Merle gene; microcornea, microcoria, corectopia, cataracts and colobomas, rudimentary lens, ectasia of episcleral vessels and optic nerve hypoplasia	Unknown	NO	1,2,3,4
B	Entropion	Lower lateral eyelid 1. Miniature long-haired Dachshunds 2. Standard smooth and long-haired Dachshunds	Unknown	NO	1,2,

C	Dermoid	Standard and miniature wirehaired Dachshunds; corneo-scleral ;	Autosomal recessive	NO	1,2,5
D	Chronic superficial keratitis	More often in wirehaired and long-haired Dachshunds ; between 2 and 3 years of age ;	Unknown	NO	1,2,6
E	Punctate keratitis	Between 1.5 and 4 years of age; mostly in long-haired Dachshunds; multiple punctate opacities	Presumed autosomal recessive	NO	2,19
F	Corneal dystrophy	1. epithelial/stromal 2. endothelial .Between 9 and 11 years of age ; it starts with central or lateral corneal edema then , with time, diffuse to all cornea	Unknown	NO	1,2,7,8
G	Uveodermatologic syndrome		Unknown	NO	2,9
H	Cataract	Subcapsular posterior cataract from 1 y.o. smooth and wire-haired miniature Dachshunds ; usually slowly progressive	Unknown	NO	1,2,28

I	Progressive Retinal Atrophy: 1. Cone-Rod Dystrophy (CORD1) 2. Classic form	1. Miniature long-haired, smooth-haired & wirehaired Dachshunds 2. Standard wirehaired Dachshunds; nyctalopia between 4 and 6 years of age	1. Autosomal recessive 2. Presumed autosomal recessive	1. RPGRIP1 and other gene(s) (MAP9)	1,2,10,11, 12,13,17,18, 20,21,22,23, 24,28,31,32, 33
J	Retinal degeneration- day blindness; Cone – Rod Dystrophy (CRD)	Miniature and standard wirehaired Dachshunds; congenital day blindness	Autosomal recessive	NPHP4	14,15,16,25, 26,30
K	Neuronal ceroid lipofuscinosis (NCL2)	Long-haired Dachshunds; a retinopathy with multifocal bullous retinal detachment was seen in 65% of dogs	Autosomal recessive	TPP1	27,29

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	Distichiasis	ACVO genetics committee
B	Iris coloboma	ACVO genetics committee
C	Persistent pupillary membranes -iris to iris -iris to cornea -iris to lens	ACVO genetics committee
D	Persistent hyaloid artery	ACVO genetics committee
E	Retinal dysplasia -focal/folds	ACVO genetics committee
F	Coloboma/Staphyloma (Smooth standard only)	ACVO genetics committee
G	Optic nerve coloboma	ACVO genetics committee
H	Optic nerve hypoplasia/micropapilla	ACVO genetics committee
I	Keratoconjunctivitis sicca	French National Panel

References

1. Rubin Lionel F., Inherited Eye Diseases in Purebred Dogs, Baltimore: Williams & Wilkins, 1989;101-107.
2. Chaudieu G. Chahory S. Affections oculaires héréditaires ou à prédisposition raciale chez le chien. 2nd ed. Ed. Du Point Vétérinaire, 2013; 259-267.
3. Sorsby A, Davey JB: Ocular associations of dappling (or merling) in the coat colour of dogs 1. Clinical and genetical data. J Genet 52:425, 1954.
4. Dausch O et al: Eye changes in the merle syndrome in the dachshund. Dtsch Tierorxrtl Wschr 84:453, 1977.
5. Brandsch H, Schmidt V: Analysis of heredity for dermoid in the dog eye. Mh Vet-Med 37:305, 1982.

6. Brandsch H, Nicodem K: Heredity of keratitis in long-haired dachshunds. *Mh Vet-Med* 37:216, 1982.
7. Martin CL, Dice PF: Corneal endothelial dystrophy in the dog. *J Am Anim Hosp Assoc* 18:327, 1982.
8. Cooley, PL, Dice DF. Corneal dystrophy in the dog and cat. *Vet Clin No Am Small An Pract* 20:681, 1990.
9. Herrera HD, Duchene AG. Uveodermatological syndrome (Vogt-Koyanagi-Harada-like syndrome) with generalized depigmentation in a Dachshund. *Vet Ophthalmol* 1:47, 1998.
10. Priester WA: Canine progressive retinal atrophy. Occurrence by age, breed and sex. *Am J Vet Res* 35:571, 1974.
11. Curtis R, Barnett KC: Progressive retinal atrophy in miniature longhaired dachshund dogs. *Brit Vet J* 149:71, 1993.
12. Turney C: Progressive retinal atrophy in the miniature longhaired dachshund: History, current work and future options. *Proc BrAVO/ECVO/ESVO/ISVO* p53, 2003.
13. Kotani T, Maehara S, Ito N, et al: Progressive Retinal Atrophy in 12 Miniature Dachshund dogs. *Proc Am Coll Vet Ophth*, p2, 2002.
14. Bjerkas E, Peiffer R: Day Blindness in Two Young Wirehaired Dachshund Siblings. *Proc Europ Coll of Vet Visual Electro*, 1:40, 2000.
15. Bjerkas E, Narfstrom K, et al: Hemeralopia in Wirehaired Dachshunds. *Invest Ophthal Visual Sci* 44: E-Abstract 2818, 2003.
16. Ropstad EO, Bjerkas E, Narfstrom K: Clinical and Fundoscopic Signs of Early Onset Day Blindness (hemeralopia) in Wirehaired Dachshunds. *ECVO Proceedings*, Abstract 09, 2005.
17. Mellersh CS, Boursnell MEG, Pettitt L, et al: Canine RPGRIP1 mutation establishes cone-rod dystrophy in miniature longhaired dachshunds as a homologue of human Leber congenital amaurosis. *Genomics* 88 (2006), 293-301.
18. Kuznetsova T, Iwabe S, Boesze-Battaglia K, Pearce-Kelling S, Chang-Min Y, McDaid K, Miyadera K, Komaromy A, Aguirre GD. Exclusion of RPGRIP1 ins44 from primary causal association with early-onset cone-rod dystrophy in dogs. *Invest Ophthalmol Vis Sci* (2012) 15;53(9):5486-501.

19. Claus BN: A genealogic survey of superficial punctuate keratitis in the population of Danish longhaired dachshunds. ECVO Proceedings, 2007.
20. Ropstad EO, Bjerkas E, Narfstrom K: Clinical findings in early onset cone-rod dystrophy in the Standard Wire-haired Dachshund. *Vet Ophthalmol* 10:69-75, 2007.
21. Turney C, Chong NHV, Alexander RA, et al: Pathological and electrophysiological features of a canine cone-rod dystrophy in the Miniature Longhaired Dachshund. *Invest Ophth & Vis Sci* 48(9):4240-4249, 2007.
22. Moriimoto, K, Miyadera, K, Kato, K, Tamahara, S, Sasaki, N, Ogawa H: Relationship between rpgrip1 mutation and progressive retinal atrophy in Miniature Long-haired Dachshund population in Japan. ACVO abstract no 62 (from Abstracts from the 39th Annual Meeting of the ACVO; Boston, MA in *Vet Ophth* vol 11 no 6 p 413-429).
23. Ropstad, EO, Narfstrom, K, Lingaas, F, Wilk, C, Bruun, A, Bjerkas, E: Functional and structural changes in the retina of Wire-Haired Dachshunds with early-onset cone-rod dystrophy. *Invest Ophthalmol Vis Sci* 49(3): 1106-1115, 2008.
24. Miyadera K, Kato K, Aguirre-Hernandez J, Tokuriki T, Morimoto K, Busse C, Barnett K, Holmes N, Ogawa H, Sasaki N, Mellersh CS, Sargan DR. Phenotypic variation and genotype-phenotype discordance in canine cone-rod dystrophy with an RPKGRI1 mutation. *Mol Vis* 11;15:2287-305, 2009.
25. Wiik AC, Thoresen SI, Wade C, Lindblad-Toh K, Lingaas F. A population study of a mutation allele associated with cone-rod dystrophy in the standard wire-haired dachshund. *Anim Genet* 40(4):572-4, 2009.
26. Wiik AC, Wade C, Biagi T, Ropstad EO, Bjerkas E, Lindblad-Toh K. and Lingaas F. A deletion in nephronophthisis 4 (NPHP4) is associated with recessive cone-rod dystrophy in standard wire-haired dachshund. *Genome Res* (2008) 18:1415–1421.
27. Awano T, Katz ML, O'Brien DP, Sohar I, Lobel P, Coates JR, Khan S, Johnson GC, Giger U, Johnson GS. A frame shift mutation in canine TPP1 (the ortholog of human CLN2) in a juvenile Dachshund with neuronal ceroid lipofuscinosis. *Mol Genet Metab* (2006) 89(3):254-60.
28. Koll S, Reese S, Medugorac I, Rosenhagen CU, Sanchez RF, Kostlin R. The effect of repeated eye examinations and breeding advice on the prevalence and incidence of cataracts and progressive retinal atrophy in German dachshunds over a 13-year period. *Vet Ophthalmol* 20(2):114-122, 2017.

29. Whiting REH, Pearce JW, Castaner LJ, Jensen CA et al. Multifocal retinopathy in Dachshunds with CLN2 neuronal ceroid lipofuscinosis. *Exp Eye Res* 134:123-132, 2015.
30. Palanova A, Schroffelova D, Pribanova M, Dvorakova V et al. Analysis of a deletion in the nephronophthisis 4 gene in different dog breeds. *Vet Ophthalmol* 17(1):76-78, 2014.
31. Das RG, Marinho FP, Iwabe S, Santana E et al. Variabilities in retinal function and structure in a canine model of cone-rod dystrophy associated with RPGRIP1 support multigenic etiology. *Scientific Reports* 7:12823I doi:10.1038/s41598-017-13112-w , 2017.
32. Busse C, Barnett KC, Mellersh CS, Adams VJ. Ophthalmic and cone derived electrodiagnostic findings in outbred Miniature Long-haired Dachshunds homozygous for a RPGRIP1 mutation. *Vet Ophthalmol* 14(3):146-152, 2011.
33. Forman OP, Hitti RJ, Boursnell M, Miyadera K et al. Canine genome assembly correction facilitates identification of a MAP9 deletion as a potential age of onset modifier for RPGRIP1-associated canine retinal degeneration. *Mamm Genome*. 2016 Jun;27(5-6):237-45.