

Breeding Guidelines using the DNA Test for Lens Luxation

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Revised 1/17/2013

[This article is online at http://sealyhealthguard.org/HealthInfo_MainPage.aspx]

Assumptions underlying these Guidelines:

DNA Test for Lens Luxation

We have a very accurate DNA test for the presence of a mutated gene (allele) which is strongly associated with primary lens luxation (PLL). *(Please read the description from the Animal Molecular Genetics Lab, University of Missouri at the end of this document).*

Any Sealy can be tested

Any Sealyham being considered for breeding should be tested, and all the puppies resulting from any mating involving a carrier or affected dog should be tested. The DNA test is available through the Orthopedic Foundation for Animals and costs \$65 (2012).

We expect that breeders will understand that testing is part of the expense of ownership and breeding, and that the price of a Sealyham puppy may need to be adjusted accordingly.

Determination of Risk

Using the DNA test, we can determine whether an individual dog is:

- at high risk of becoming affected (carrying two copies of the gene);
- at low risk of becoming affected (carrying one copy of the gene);
- at no risk of becoming affected (carrying no copies of the defective gene).

Loss of good traits in a small gene pool

All Sealyham owners and breeders should understand that because the total population is so small, the breed is at great risk for losing diversity in its gene pool. We know that a significant number of Sealyhams are carriers, including many of our best dogs. That means if we only use clear dogs (dogs not carrying the PLL gene), many good traits could disappear within just a few generations, and the breed could become more susceptible to the emergence of other genetic diseases besides PLL if the gene pool (the population of breeding dogs) becomes smaller.

Testing our dogs for the presence of the gene involved in lens luxation allows us to continue to use dogs in our breeding programs who have great traits but may be carriers of the lens luxation gene. Testing also is crucial to provide us with the data which can show whether the prevalence of lens luxation is decreasing over

time in our breed.

We should not remove good dogs with good inheritable traits from our breeding programs just because they carry the gene for PLL. Instead, using the DNA test, we must carefully manage our breeding program to minimize the risk of producing affected dogs, while maximizing the diversity of the gene pool and encouraging the flow of good traits through our breed.

Goals of these Breeding Guidelines

The purpose of this breeding protocol is twofold:

- To gradually reduce the percentage of Sealyham Terriers who are Carriers or Affecteds;
- To gradually increase (or at a minimum preserve) the diversity of the gene pool and breeding stock.

Priorities for Breeding decisions:

(NOTE: For a graphical picture of how single recessive gene inheritance works, see Genetics 101 on the home page of the SealyHealthGuard.org website.)

There are six different situations a breeder can encounter when she decides to mate a dog and a bitch and is concerned with selecting against a single recessive gene trait:

- Clear to Clear: This breeding will produce only puppies who are clear (not carriers).
- Clear to Carrier: Any puppy from this breeding will have a roughly equal chance of being either clear or a carrier.
- Carrier to Carrier: Any puppy from this breeding will have about a 25 percent chance of being either clear or affected, and a roughly 50 percent of being a carrier.
- Clear to Affected: Any puppy from this breeding will be a carrier, but is unlikely to be affected.
- Carrier to Affected: Any puppy from this breeding will be equally likely to be either a carrier or affected.
- Affected to Affected: All puppies from this breeding are likely to be affected.

Given that three of the above situations are very unlikely to produce an affected, we can rank those three cases in order of priority depending on the ratio of Clears to Carriers likely to be produced:

- **Top Priority:** mating a Clear to another Clear;
- **Second Priority:** mating a Clear to a Carrier,
- **Third Priority:** mating a Clear to an Affected.

The risk for producing an Affected in any of these three situations is very low.

Note: All of these situations require that one of the dogs be a Clear.

Note : In the Third Priority case, one of the dogs can be an Affected (remember that with the DNA test we can identify a dog with two copies of the defective gene when it is a puppy, years before it might actually show any symptoms.) Breeding an Affected may seem counter-intuitive, but bear in mind that if you have an Affected with many very good traits, breeding that dog to a Clear will not produce any Affecteds, though it will produce Carriers.

Testing and Record Keeping

This breeding protocol will fail without the testing of all dogs being considered for breeding, and without accurate record-keeping of the results of those tests. Ideally each breeder should have all the puppies in a litter tested, but if that is not possible, then at a minimum no dogs should be bred who have not been tested.

Results of all tests should be entered in the on-line SealyHealthGuard.org data base so that the status of the DNA test of any dog is available to any breeders, buyers or owners. However, if for some reason a breeder does not want to participate in SealyHealthGuard, that breeder must provide the results of any DNA tests of a dog to the person who buys or acquires that dog.

Summary

These guidelines allow us to use any Sealy with good traits in our breeding programs, whether that dog is a Clear, a Carrier, or even an Affected, as long as one of the pair of mated dogs is a Clear. We can test both dogs in the pair we are considering, and make the breeding decision based on the three top priorities listed above. Even if breeders do not test their litters, we can still follow this protocol by testing breeding pairs before they are bred to ensure that the risk of producing affected dogs is very low.

Appendix to ASTC Breeding Guidelines:

(For more info: <http://www.caninegeneticdiseases.net/>)

Description of the DNA test from the University of Missouri College of Veterinary Medicine

Research at the University of Missouri led to identification of a DNA mutation that predicts which dogs are at risk for developing lens luxation as they age. Working independently and using other breeds, the researchers at the Animal Health Trust found the same mutation a few months later. This independent confirmation of the finding makes both labs confident that the correct mutation has been identified, and that the test

is valid for many breeds. A simple DNA test will reveal if a dog is NORMAL (has 2 normal copies of the gene), a CARRIER (has one normal copy and one mutated copy of the gene), or AFFECTED (has 2 mutated copies of the gene). Wise use of this test will allow breeders to avoid producing individuals destined to develop lens luxation, while still retaining many other desirable traits in their dogs.

Testing and Inheritance of PLL

From pedigree studies done previously, there has been general agreement that PLL is inherited as a simple recessive trait. This means that a dog needs 2 mutated, or “bad” copies of the gene to show the disease. With the PLL mutation identified, and the research groups able to compare notes on the dogs used in the study, it has become apparent that there are some exceptions. While the vast majority of dogs with PLL have tested AFFECTED, a small percentage of the dogs that test CARRIER are also at risk of developing PLL. Owners and breeders should be aware of this and understand the implications of the test results so that they can make well-informed decisions for the future of individual dogs, and the breed as a whole.

Dogs that test AFFECTED have 2 mutated copies of the gene. The vast majority of these dogs will luxate at 4-8yrs of age, the typical age of onset for PLL. There were a few dogs in the study group that tested as AFFECTED but did not luxate until after 8 yrs of age, and some dogs testing AFFECTED have died from other causes without luxating. A search of published veterinary literature revealed that about 10% of the dogs reported to be clinically affected with PLL had onset of symptoms after 8 yrs of age. Because of this, the test results will say “AFFECTED/HIGH RISK”.

As stated earlier, dogs testing CARRIER are at a slight risk of developing PLL. Carriers have one normal and one mutated copy of the gene. They could pass either the normal copy or the mutated copy on to their offspring. Because there were a very few cases of dogs in the research groups testing CARRIER who did appear to have PLL, the test results will say “CARRIER/LOW RISK”.

A dog testing NORMAL has 2 normal copies of the gene, is not at risk for developing PLL, and can only pass a normal copy of the gene to any offspring.

Breeders and individual owners are now able to test any dog using the testing kit that can be ordered online through the [OFA website \(www.OFFA.org\)](http://www.OFFA.org). DNA is collected using a cheek swab, and the barcoded sample will be tested by the Animal Molecular Genetics Lab at the University of Missouri, with results reported directly to the owner by OFA.

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