

Hip Dysplasia in Agility Dogs

Pathophysiology, Screening Methods, and Treatment Options

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Hip dysplasia is a generic term that describes the abnormal formation of the ball and socket joint of the hip. See **Figure 1**. In the immature dog, there is hip laxity with the end result being hip osteoarthritis (OA) in the mature dog. While the condition can affect the lifestyle of our canine companions, there are steps we can take to treat and manage the disease. We can slow the development of OA and minimize the dogs' discomfort.

What Causes Hip Dysplasia?

So what causes hip dysplasia? The cause is not entirely understood; however, there are certainly several genetic, environmental, and developmental components. It is largely considered multifactorial, that means that there is no one cause of hip dysplasia, but rather multiple causes. The best analogy is to think of it like a recipe. There are multiple steps required to bake a cake. Should you mess up one step of the recipe, the cake will likely turn out okay. But if you mess up multiple steps, the cake will probably not be good. It is the same with hip dysplasia. Genetics alone will likely not cause hip dysplasia, but the combination of genetics with various environmental and developmental issues may result in a patient suffering from hip dysplasia.

Genetics, in part, may result in conditions leading to an increased risk of lax-



This is an extended pelvic view of a patient with bilateral hip laxity and secondary osteoarthritis. Notice how the femoral head (ball) does not fit completely or appropriately into the acetabulum (socket).



This is an extended pelvic view of a patient with normal hips. Notice how the femoral head fits completely and appropriately into the acetabulum. At least 50% coverage is considered to be the minimal amount of coverage needed.

ity of the ball and socket joint of the hip. Hip laxity refers to the degree of “looseness” of the ball in the hip socket. In the immature dog, this laxity will result in abnormal wear and tear of both the ball and the socket. It is suspected that during movement, when the immature dog's foot is in the air, the hip subluxates. Then once the dog places the foot on the ground, the hip reduces. This repetitive subluxation and reduction results in remodeling of both the head of the femur (the ball) and the acetabulum (the socket). Abnormal wear and tear on a joint results in cartilage damage and ultimately OA.

Laxity is thought to be the common denominator that determines whether an animal will develop OA, and the development of laxity is multifactorial. Suggested causes and effects of laxity include: 1) thickening of the ligament that connects

the femur to the socket or acetabulum; 2) increased joint fluid; 3) an abnormal composition of the joint capsule; and 4) biomechanics.

Screening Methods

In the USA, there is only one screening method for *early detection* of hip laxity, the PennHIP (Pennsylvania Hip Improvement Program) evaluation. The Orthopedic Foundation for Animals (OFA) is a screening tool used largely for the detection of osteoarthritis as the consequence of hip dysplasia

PennHIP

The PennHIP was first started in 1993 at the University of Pennsylvania as a method for the early diagnosis of hip dysplasia by detecting hip laxity. The method requires patients to be sedated or under general anesthesia, and three radiographic views of the hips are obtained: 1) a compression view; 2) a distraction view; and 3) an extended view. See **Figures 2 and 3**.



This is a compressed view of the pelvis for PennHip evaluation.



This is a distracted view of the pelvis for PennHip evaluation. A distraction index (DI) can be calculated to help guide decision making about young dogs with hip dysplasia.

Acquisition of PennHIP radiographs requires certification, and therefore cannot be performed by all veterinarians. All radiographs evaluated must be submitted for analysis and inclusion in the PennHIP database.

Radiographs are assigned a distraction index (DI), which quantifies the amount of laxity of the hip joint. The distraction index can then be used to predict the probability that a dog will develop hip OA by the age of 36 months. Congruency, or how well the ball and socket fit together, is also assessed.

The PennHIP evaluation may be done on dogs as young as 16 weeks of age, but has shown the most reliable results for detecting future osteoarthritis when performed on dogs one year of age. The best way to think of a PennHIP evaluation is that it is looking for the problem on the train before it leaves the station. It should be noted that PennHIP is a screening tool, not a certification process.

OFA

The OFA provides a screening service for hip dysplasia based on a single radiograph (the hip extended view). Patients undergoing OFA radiographs do not have to be sedated or anesthetized, but it is recommended. The radiographs are classified into seven different categories: Excellent, Good, Fair (all within normal limits), Borderline, Mild, Moderate, or Severe (all considered dysplastic). The classification is based on a report by a team of radiologists evaluating approximately nine different anatomic areas of the hip. Unfortunately, it has been shown there is about 75% disagreement between radiologists for a single patient.

For interpretation, radiographs must be of the animal appropriately positioned and must be identified with the animal's registration number or name, the date the radiograph was taken, and the veterinarian or veterinary hospital name. The submission process is voluntary, and thus, many dogs with lax hips or evidence of OA may not have the films submitted, which would falsely lower the prevalence of hip dysplasia. Official OFA grades are not assigned until an animal is 24 months of age. Therefore, the best way to think OFA evaluation is looking for the problem well after the train has left the station.

In the authors' opinion, a PennHIP evaluation carries more clinically relevant information in regards to diagnosis, breeding, screening, and treatment options.

Conservative Management

Once a dog has been diagnosed with hip dysplasia, it is important to understand and consider the various treatment options. Likely the most important thing to understand is that approximately 80% of dogs diagnosed with hip dysplasia can be managed by conservative means and do not require any surgery.

The two most important components of conservative management are weight control and daily exercise. Ensuring patients with hip dysplasia are not overweight will prevent undue stress on the hip joints and will reduce joint inflammation as well as slow the progression of OA. Controlled daily exercise is also important to encourage the animal to maintain muscle mass, hip range of motion, and lean body weight while avoiding pain and stiffness of the hip joints. An inactive dog with hip dysplasia will develop a worsening hip range of motion due to scar tissue formation around the joint. This effect will lead to more pain and discomfort and thus less activity, which results in more weight gain and then exacerbates the progression of OA.

In patients with hip dysplasia, the authors' commonly advise owners to allow a period of a light warm-up followed by a daily walk that can include (pending the patient's comfort) inclines, declines, stairs, and uneven terrain. Once the walk is completed, then the dogs will perform sit-to-stand exercises followed by "dancing" exercises (initially this will be forward dancing, then once comfortable, it can be performed by having the dog walk backward). Once the exercises are completed, there is a light cool-down period followed by passive range of motion exercises and stretching. The goal is for this routine to be completed twice daily.

It should be noted that having a patient trot does not increase hip extension any more than walking. In addition, sit-to-stand exercises will not increase hip extension but can increase the overall hip range of motion. Dancing exercises will increase hip extension as will walking up inclines and stairs.

Open water swimming can be particularly beneficial for maintaining body condition and endurance while avoiding detrimental concussive forces. However, it should be noted that free water swimming will not improve a dog's hip range of motion any more than walking. Underwater treadmill therapy is likely the better form of hydrotherapy as it can increase a dog's hip range of motion, improve body condition, and build muscle mass all while avoiding concussive forces.

Nutraceuticals are disease-modifying agents, may be beneficial in slowing down and minimizing the progression of OA. The most commonly recommended nutraceuticals include glucosamine and chondroitin supplements, and omega-3 fatty acids (fish oil).

Formal physical rehabilitation can be used in patients that are experiencing pain and discomfort. The goal of rehabilitation is to allow resolution of inflammation (commonly employed with the usage of pain medications or joint injections), improve hip range of motion, improve muscle mass, and relieve compensatory issues.

The final but most important component to conservative management is pain relief. This is commonly controlled with anti-inflammatory drugs (NSAIDs), which are given on an as-needed basis at the lowest dose possible as infrequently as possible. Joint injections can be considered for temporary relief with the goal being to decrease the inflammatory response. Such substances as steroids, hyaluronic acid, or regenerative medicine could be considered.

Surgical Treatment Options

The options for surgical management of hip dysplasia are often dictated by the patient age and stage of the disease. In immature patients, surgical options may include juvenile pubic sym-

physis, triple pelvic osteotomy, femoral head osteotomy, and total hip replacement. In mature patients, the surgical options are limited to femoral head osteotomy and total hip replacement.

Juvenile Pubic Symphysis

A juvenile pubic symphysis (JPS) is a procedure performed in 10- to 16-week-old puppies that have been diagnosed with hip dysplasia. Hence, a PennHIP evaluation is critical in young dogs that may be susceptible to hip dysplasia. The procedure is relatively simple and involves using electrocautery to induce premature closure of the cranial pubic symphysis. This allows continued development of the hip routinely; however, as the dog matures, it will result in improved coverage of the ball into the socket, thus eliminating laxity and hopefully preventing the development of OA.

The procedure is minimally invasive with minimal potential for post-operative complications. Patients must still have significant remaining growth potential, and thus the JPS procedure is not recommended in puppies older than 18 weeks. At the current time, it is recommended that a dog is spayed/neutered at the time of the JPS. While the authors fully support waiting until after sexual maturity for spaying and neutering, unfortunately, it is impossible to tell if a dog has had a JPS when evaluating radiographs. Since the procedure will result in improvement in laxity and thus an improvement on radiographs, not spaying/neutering an animal could result in a dog with poor genetics being retained in the breeding pool.

Triple (or Double) Pelvic Osteotomy

A triple pelvic osteotomy (TPO) is a surgical procedure which involves making three cuts into the pelvic bone, while a double pelvic osteotomy (DPO) involves making two cuts (osteotomies) into it. Both procedures essentially allow free rotation of the section containing the acetabulum (hip socket). Similar to the JPS, the acetabulum is rotated to improve coverage of the femoral head. The bone is held in this position using a special bone plate until it heals. The goal of the TPO is similar to the JPS in that by improving coverage of the femoral head. We are decreasing laxity or movement within the joint and thus preventing or delaying secondary osteoarthritis.

For a dog to be a candidate for a TPO, they must have dysplasia with a normally shaped femoral head and acetabulum (i.e., no evidence of osteoarthritis). This typically limits this procedure to dogs 6 to 10 months of age.

Total Hip Replacement

A total hip replacement (THR) is a surgical procedure that involves the replacement of the acetabulum (socket) and femoral head (ball) with synthetic implants. See **Figure 4**. The implants are held in position using either bone cement or "press-fit" (bone ingrowth) methods. Patients receiving a THR have been shown to have excellent clinical outcomes in terms of restoring normal function and range of motion. Thus, a THR is considered the gold standard in terms of eliminating pain and dysfunction in dogs with hip dysplasia. This is the recommended procedure for mature dogs who are still expected to maintain a high level of activity.

A THR can be performed in dogs as young as 10-13 months of age or anytime during the dog's life.

Femoral Head Osteotomy

A femoral head osteotomy (FHO) is a surgical procedure that involves the removal of the femoral head (ball) to reduce pain



This is an extended pelvic view of a patient after receiving a cementless total hip replacement (THR) of the right hip for hip dysplasia. Notice how the left hip joint is still abnormal. A THR would be the recommended choice for canine athletes.



This is an extended pelvic view of a patient after undergoing a femoral head osteotomy (FHO). Notice how all of the femoral head and neck are removed. This is salvage procedure to alleviate pain; most patients will not return back to sport after an FHO.

associated with abnormal joint contact points. See **Figure 5**. Patients will develop a “false joint,” known as a pseudarthrosis, formed by scar tissue surrounding the joint following the procedure in addition to the muscles of the hip. While an FHO has been shown to alleviate pain and reduce the need for pain medications, patients do lose range of motion and limb length, and thus an FHO is not recommended in dogs intended for high levels of activity, such as hunting, agility, or any sporting activity.

An FHO is considered a salvage procedure; for the best functional outcome, a formal rehabilitation program would be recommended to begin within three to five days following surgery.

In Conclusion

While a diagnosis of hip dysplasia is often a terrifying thing for dog owners to hear, it is important to remember there are many conservative and surgical options to ensure our canine companions are still able to maintain a good quality of life. 🐾

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