Canine Hip Dysplasia

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Pathophysiology, Genetics, Environmental Factors, Clinical Signs, Diagnosis and Available Treatment Options

Hip Dysplasia and Your Dog

Hip dysplasia is a common and potentially debilitating joint disease in dogs. Although occurring in many canine lines, hip dysplasia most often affects large dog breeds. The Golden and Labrador Retrievers, German Shepherd Dogs, Rottweilers, and Chow Chows are particularly susceptible to hip dysplasia. Fortunately, there are a number of treatment options available for dogs afflicted with this painful and degenerative disease.

- Hip dysplasia is a common inherited condition that affects the hip joint of dogs
- Proper medical and surgical treatment can result in long active lives.
- All dogs that develop hip Dysplasia most likely were born with normal hips.

Hip Dysplasia accounts for over 30% of all orthopedic cases in veterinary practice and the Orthopedic Foundation for Animals (OFA).

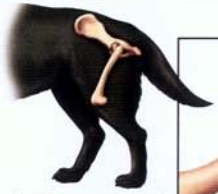
What is hip dysplasia?

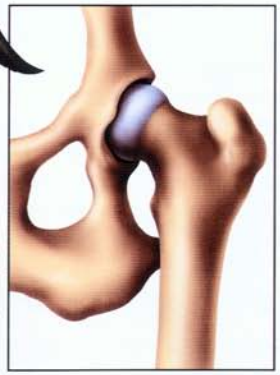
Hip dysplasia is a developmental disorder affecting the coxofemoral (hip) joints in dogs. The problems associated with hip dysplasia stem from an imbalance in the muscle mass and mechanical forces which are centered on the hip joint. This imbalance is associated with excessive laxity (looseness) which is usually the result of a shallow acetabulum (cup). When the hip joints exhibit laxity, the ball of the femur rides on the edge of the socket rather than gliding smoothly in the socket. This results in pain and eventually to the formation of abnormal calcium deposits, bone spurs and/or arthritis. Eventually, some hip joints will suffer either a partial or complete luxation. Continued use of the affected joint causes abnormal wear on the joint's cartilage surfaces leading to further damage and a self-perpetuating degenerative process ensues. Abnormal bony development of the hip joint often results, and inflammation and irritation (arthritis) ultimately cause mild to severe lameness. The joint capsule becomes inflamed and a subsequent increase in synovial fluid in the joint exacerbates the laxity.

These physiological changes should be dealt with early (between 4 and 8 months) to attempt to reduce the progress toward degenerative joint disease. The hallmark sign of degenerative joint disease is articular cartilage damage. This results in the exposure of subchondral bone and pain nerve fibers resulting in significant joint pain. Once degenerative joint disease is present, there are fewer treatment options available.

Breeds Commonly Affected

Afghan Hound
Airedale Terrier
Akita
Alaskan Malamute
American Bulldog
American Eskimo Dog
American Staffordshire Terrier
American Pit Bull Terrier
American Water Spaniel
Anatolian Shepherd Dog
Australian Cattle Dog
Australian Shepherd
Bearded Collie
Belgian Malinois
Bernese Mountain Dog
Bloodhound
Border Collie
Boxer
Bullmastiff
Chesapeake Bay retriever
Chinese Shar-Pei
Chow Chow
Clumber Spaniel
Curly-Coated Retriever
Dachshund
Dalmatian
English bulldog
English setter
Flat-coated retriever
German shepherd dog
German shorthaired pointer
German wirehaired pointer
Golden retriever
Great Dane
Great Pyrenees
Irish setter
Irish wolfhound
Keeshond
Labrador retriever
Mastiff
Neopolitan mastiff
Newfoundland

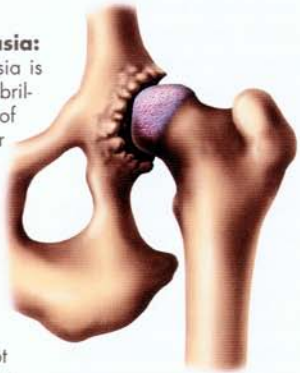




Normal Hips: Normal, healthy hip joint with a deep acetabular cup and healthy cartilage in the cup and on the ball of the femur. Note how the head of the femur sits tightly within the acetabulum.

Early/Mild dysplasia: Early/ Mild dysplastic hip with no degenerative changes. Note how joint laxity allows the head of the femur to subluxate. The acetabular cup may be abnormally shallow and the joint may exhibit laxity. This stage of hip dysplasia can often be treated with corrective surgery *(see TPO in this brochure)* before the disease progresses—requiring more invasive and costly surgery.

Moderate/Severe dysplasia: Moderate/ Severe hip dysplasia is recognized by the cartilage fibrillation and erosion on the ball of the femur and the acetabular cup. There is also a buildup of osteophytes (bone spurs and calcium deposits) around the rim of the acetabular cup. This is a very painful joint that requires corrective surgery to alleviate the pain and return the joint to normal function. If corrective action is not taken then the dysplasia will inevitably progress to severe.



Severe dysplasia: Severe dysplasia is common in older dogs whose hip dysplasia has gone untreated for an extended period of time. This hip joint has severe arthritis. Note the flattening of the head of the femur and added bone fillings around the neck of the femur and within the acetabulum This dog's joint requires a total hip replacement to restore his quality of life and provide him with a pain-free, normal functional hip joint.

Norwegian Elkhound
Old English sheepdog
Pointer (English pointer)
Rhodesian ridgeback
Rottweiler
St. Bernard
Staffordshire Bull Terrier
Samoyed
Springer spaniel, English
Springer spaniel, Welsh
Vizsla
Weimaraner

Although hip dysplasia is heritable, it can skip individuals or even whole litters in affected lines.

The Genetics of Hip Dysplasia

The heritability of hip dysplasia has been firmly established. Several genes have been found to contribute to the ultimate size, shape, strength and growth potential of the hip joint. Furthermore, hip dysplasia is a genetically additive disease; the severity of the affliction is largely the result of a number of disease-related genes present in a particular animal.

The multitude of genetic and environmental factors that influence the transmission and development of hip dysplasia make it difficult to predict how the disease will be expressed. It is safe to say that breeding dogs between phenotypically normal dogs will generally result in more normal puppies than will breeding a dysplastic and normal dog or two dysplastic dogs to each other. However, studies have shown that even when both parents are phenotypically normal they can still

produce offspring that are phenotypically dysplastic [1]. In spite of careful breeding efforts and the use of classifications from the Orthopedic Foundation for Animals (OFA), such as breeding animals whose parents and grandparents were normal, the progress toward eradication of this disease has been frustratingly slow.

The OFA Hip Registry

The Orthopedic Foundation for Animal's Hip Registry is designed to provide a standardized criterion for evaluation of CHD and develop a multi-breed database. This database is used to develop selective breeding programs that reduce the prevalence of CHD. The OFA requires symmetrical radiographs of the pelvis. These radiographs are evaluated by three board certified radiologists and classified as excellent, good, fair, borderline, mild, moderate or severe. Excellent or good classifications on individuals older than 24 months receive a breed registry number. A preliminary evaluation may be performed as early as 4-5 months with 90% accuracy.

Environmental Factors and Hip Dysplasia

Environmental factors do not cause hip dysplasia but can significantly affect whether or not the condition will eventually manifest itself and to what degree. Environmental influences help explain the fact that only animals with a hip dysplasia genotype can develop the condition while not all animals with the genotype will exhibit the disease.

Nutrition in the young dog is one of the most studied exogenous elements affecting the development of hip dysplasia and may have a profound influence on the development of the disease. One study noted that only 33% of dogs that were fed ad libitum developed normal hips, whereas 70% of the dogs that were fed one quarter of the same diet developed normal hips. Another study in German Shepherds showed that 63% of the dogs weighing more than the mean, developed dysplastic hips. In contrast, 37% of the dogs that weighed less than the mean developed dysplastic hips [2]. Puppies that are genotypically susceptible to canine hip dysplasia will exhibit an increased incidence and severity if placed on a high caloric diet. **These studies strongly suggest that limiting caloric intake in young, growing dogs (especially the larger at risk breeds) is beneficial in preventing the development of canine hip dysplasia.**

- Environmental factors such as diet and excessive exercise play an important role in the development of CHD.
- Ask your veterinarian for recommendations on diet and exercise.
- Over 110 dog breeds have been identified with hip dysplasia.
- About 95% of dogs with hip dysplasia are affected in both hip joints.

Clinical Signs of Hip Dysplasia

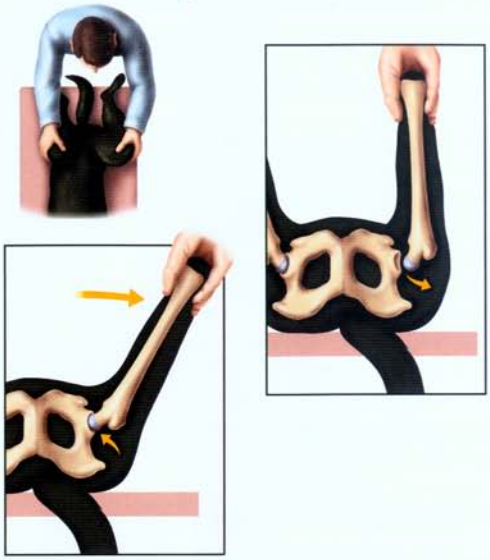
Dogs suffering from hip dysplasia are often reluctant to jump or rise from the rear legs, exhibit abnormal locomotion and may hesitate to climb and descend stairs. Young dogs in the age range of five to ten months may exhibit pain when the hips are extended. In addition, there may be evidence of decreased muscle mass and a reduced range of motion. Many of these young dogs have a torn round ligament and a significantly stretched joint capsule. Clinical signs often do not correlate well with radiographic changes in young dogs. As the dog becomes older and more radiographic evidence of degenerative joint disease is present, the veterinarian can rely on the radiographs with more certainty. It is important for veterinarians to do a complete lameness evaluation of the patient to rule out other neurologic or orthopedic disease processes. It is also important to note that a number of these dogs will exhibit secondary changes in other limbs due to gait alterations associated with protecting the lame hips.

Diagnosing Hip Dysplasia

Hip evaluations must not be delayed until two years of age (especially in susceptible breeds), but should be performed as young as five to six months old. Cup depth and joint laxity should be assessed and dogs that exhibit irregularities should be identified as soon as possible. Radiographs are utilized to confirm the presence of joint laxity in young dogs and the presence of degenerative joint disease in the older patient. Joint laxity without associated arthritis is most common in dogs between four and twelve months old and can be difficult to diagnose through x-rays.

Using a technique called palpation and hip manipulation, veterinarians can often detect hip dysplasia before symptoms become evident and when radiographs fail to identify malformations **(Table 1)**. In a palpation exam, the rear leg is extended to test the hip's range of motion.

Palpation Exam



Palpation exam: Using a technique called palpation and hip manipulation, veterinarians can often detect hip dysplasia before symptoms become evident and when radiographs fail to identify malformations. Moving the knee towards the center causes the hip to fall out of its socket (subluxate). Moving the knee away from the center causes the hip to return to the socket (reduction). These two actions allow the veterinarian to measure the corresponding angles which indicate the amount of joint laxity.

Another part of a palpation exam requires that the dog be anesthetized to allow the hip to be palpated without the dog holding the hip in its socket using its muscles creating a false negative result. During this palpation the veterinarian can assess the laxity of the hip by measuring the angle that the hip subluxates (slips out of the socket) and the angle that it reduces (returns back into the socket). These angles are important in deciding the available treatment options. Palpation also allows for early detection of hip dysplasia which gives the dog a better chance for a normal life without the need for a total hip replacement.

Penn Hip Certification

The Penn Hip system was developed to provide a reliable method for predicting the development of CHD. Proponents of this system claim disappointing results in traditional method for reducing the prevalence of CHD. This system can be used in dogs as early as 16 weeks of age. It is based on quantitatively measuring joint laxity

Table 1

Effective Diagnosis of Hip Dysplasia

Age	Palpation	Radgphs
6 months	75%	25%
1 year	50%	50%
1.5 years	25%	75%
2 years	0%	100%

and helps identify susceptible individuals before degenerative changes are present. The Penn Hip method uses three separate radiographs, taken under deep sedation or general anesthesia. They include a distraction view, a compression view for evaluating joint laxity, and a hip-extended view for evaluating degenerative changes. The degree of laxity reported as a distraction index (0 to 1 with 0 being tight) is an important risk factor in determining whether a dog will develop CHD. The more laxity as indicated by a higher distraction index, the greater the chance of developing CHD. This information can be used for decisions about breeding, life style for the dog and potential surgery.

Treatment Options for Hip Dysplasia

Medical Management

Prompt and early diagnosis of canine hip dysplasia increases the number of available treatment options and thus helps prevent the pain and arthritis that accompany the advanced disease. Medical management may control the clinical signs of some dogs with hip dysplasia. Treatment is directed at reducing cartilage wear and slowing the progress of degenerative joint disease. Pain control agents, such as nonsterioidal anti-inflammatory drugs and chondroprotective agents, are typically used to manage the disease. Dietary alterations to control growth in young dogs and weight in older dogs are crucial in the medical management of hip dysplasia. The analgesic and anti-inflammatory effects of medical management unfortunately may only mask the development of a degenerative condition and may not be the best course of action to ensure a favorable outcome. Owners of dogs with dysplastic hips should also be advised that while medical therapy may be an effective short-term relief, it may allow progress of the disease to the point where only salvage-level surgical procedures are possible. Therefore, if medical management is pursued, close clinical and radiographic monitoring of the condition is imperative in order to prevent closing windows of opportunity for surgical options.

Surgical Management

Surgical management of canine hip dysplasia, especially if performed early in the course of the disease, improves the prognosis for a long-term acceptable joint function. Surgical management is pursued if medical management is no longer successful in controlling the clinical and radiographic signs, if the owner is concerned with the long-term comfort and limb function for the dog, if the dog is intended to perform an athletic function and to slow or stop the progress of degenerative joint disease in the young dog.

Surgical options include:

- Saving the natural joint (TPO or JPS)
- Replacing the natural joint (Total Hip Replacement)
- Natural joint removal (excision arthroplasty).

Triple Pelvic Osteotomy (TPO)

The triple pelvic osteotomy was developed for patients in the early stages of canine hip dysplasia who exhibit minimal degenerative changes in their hip joints. This procedure significantly reduces hip laxity by rotating the cup further over the ball of the femur and thereby curtailing the painful onset of degenerative joint disease by creating a more normal joint environment. In performing this procedure, the veterinary surgeon cuts the pelvis to allow rotation of the acetabulum further over the ball of the femur. The rotated pelvis is then stabilized by a specially designed surgical implant. If the disease is bilateral, both hips will require surgery. The two surgeries are typically staged, however, in the time it takes for the first hip to recover from surgery, the disease continues to progress in the other hip and can often preclude the option to salvage the dog's own hip. The good news:

Triple Pelvic Osteotomy (TPO) for the treatment of hip dysplasia. A specially designed surgical implant stabilizes the pelvis after being rotated 25-35 degrees to better capture the ball of the femur in the acetabular cup.

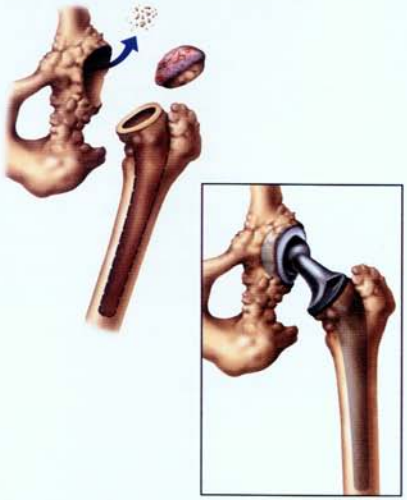
"Dr. Rooks and the Triple Pelvic Osteotomy technique that he developed altered the future of Kodiak's life"

A recent technique and special plate, developed by Dr. Robert Rooks at All-Care Animal Referral Center, allows both sides to be operated at the same time, thereby giving each hip an equal and more successful chance at returning to full function.

Postoperative care for dogs that have undergone pelvic osteotomy involves antibiotic administration, exercise restriction, physical rehabilitation and a rest period to ensure adequate healing of the surgical site. Routine postoperative examinations by a veterinarian, including pelvic radiographs, are essential to evaluate the recovery process.

Total Hip Replacement (THR)

Total hip replacement involves the replacement of the diseased hip joint with a hip prosthesis. This surgery may be performed at any stage of hip dysplasia but is most appropriate in patients who have the latter stages of degenerative joint disease or severe luxation. Radiographic changes including flattened femoral heads, shallow acetabulum and bony osteophytes are the classic signs of degenerative joint disease. These patients are not suitable candidates for pelvic osteotomy because of



Total Hip Replacement (THR) for the treatment of moderate to severe hip dysplasia. This procedure involves the removal of the dog's diseased hip joint and replacing it with a fully functional prosthesis.

the presence of degenerative joint disease and the lack of a normal joint surface. Total hip replacement is considered by many surgeons as the gold standard for the treatment in advanced canine hip dysplasia. THR patients experience an excellent success rate and usually recover fully from their surgery and lead active, athletic lives.

Postoperative care of a total hip replacement patient typically involves antibiotic administration, exercise restriction, physical rehabilitation and rest for a few weeks. The dog is monitored on a regular basis using pelvic radiographs to ensure that all implants have been well seated and the prosthesis is functioning well.

Femoral Head and Neck Excision Arthroplasty

This salvage procedure is utilized for dogs whose owners may have limited financial means that hope to improve the quality of life for their dog. The best candidates for this procedure are dogs that weigh less than 40 pounds.

During femoral head and neck arthroplasty no rotation of the acetabulum is attempted and no implants are installed. Instead the femoral head and neck are simply removed to alleviate the pain associated with joint articulation. The joint space is then allowed to fill with fibrous connective tissue that serves as a pseudoarthrosis or a joint. Although many dogs appear to have normal function after femoral head and neck excision arthroplasty, it is difficult to evaluate the degree of discomfort associated with the procedure. These patients typically exhibit a reduced range of motion but this may be minimized through the use of physiotherapy including passive motion, swimming and other physiotherapy techniques. Postoperatively, antibiotics are administered for the first few days after surgery, but unlike the other procedures exercise may not be restricted and in fact the clients are instructed to flex and extend their dog's hips.

Juvenile Pubic Symphysiodesis (JPS)

This surgical procedure is performed on puppies whose hips exhibit abnormal amounts of laxity. It involves the use of electrocautery to prematurely close the pubic symphysis. The remainder of the pelvis continues to grow and the closed pubic symphysis forces the hip socket to rotate into a more normal alignment. The surgery must be performed before 20 weeks of age and best if done between 12-18 weeks as it relies on growth of the pelvis to be effective.

Conclusion

Hip dysplasia is a heritable, polygenetic, multifactorial, degenerative condition of the hip joint of dogs. Its expression and severity, while influenced by genetics, is also affected by environmental factors. The surgical treatment options, and thus the prognosis for dysplastic patients, depend heavily on the degree of degenerative joint disease, the owner's expectations for the use of the dog and financial means. Prompt and accurate diagnosis of the condition will allow the most effective surgical management of the disease and result in a high quality of life for the dog.

Glossary

acetabulum	*the socket component of the hip joint, and part of the pelvis.*
arthritis	*a chronic degenerative condition of the joint, which can cause pain and is usually associated with added bone around the joint.*
atrophy	*a wasting, or loss of mass, especially muscle.*
bilateral	*on both sides, left and right.*
congenital	*present at birth.*
dysplasia	*abnormal development of a body part.*
dysplastic	*having canine hip dysplasia.*
femoral	*relating to the femur.*
femur	*the thigh bone.*
lameness	*abnormality in gait, limping.*
laxity	*looseness, usually related to a joint.*
luxation	*when a joint is completely out of place, or dislocated.*
ostectomy	*a cutting and removing of bone.*
osteotomy	*a cutting of bone, as with a saw.*
pelvic	*relating to the pelvis.*
pelvis	*the basin-like skeletal structure that connects the spinal column to the hind limbs.*
phenotype	*exhibiting physical characteristics as dictated by genetic and environmental influences*
prosthesis	*an artificial device used to replace a missing body part.*
radiographs	*x-rays.*
subluxation	*when a joint is partially out of place, or partially dislocated.*

References

1. Lust, G., An Overview of the Pathogenesis of Canine Hip Dysplasia, JAVMA, Volume 210, Number 10, p. 1445. May 15, 1997.
2. Kealy, R.D., et al., Effects of Limited Food Consumption on the Incidence of Hip Dysplasia in Growing Dogs, JAVMA, Volume 201, Number 6, p. 857

"There really are no words that express the gratitude
I feel for the care given to Rylee...
first for the arthroscopic surgery to her right arm
and then to the total replacement of her left hip.
She is doing better than I could have
ever imagined after just a couple months."