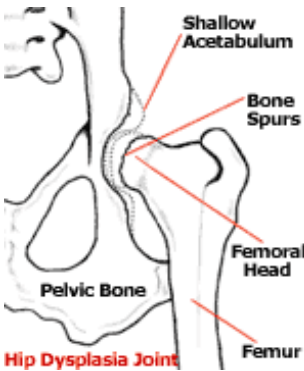
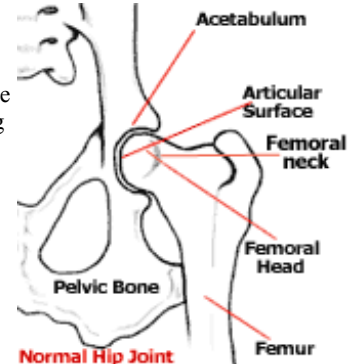


Hip Dysplasia in Dogs: Diagnosis, Treatment, and Prevention

Drs. Foster & Smith Educational Staff

What is hip dysplasia?

To understand hip dysplasia we must have a basic understanding of the joint that is being affected. The hip joint forms the attachment of the hind leg to the body and is a ball and socket joint. The ball portion is the head of the femur while the socket (acetabulum) is located on the pelvis. In a normal joint the ball rotates freely within the socket. To facilitate movement the bones are shaped to perfectly match each other; with the socket surrounding the ball. To strengthen the joint, the two bones are held together by a strong ligament. The ligament attaches the femoral head directly to the acetabulum. Also, the joint capsule, which is a very strong band of connective tissue, encircles the two bones adding further stability. The area where the bones actually touch each other is called the articular surface. It is perfectly smooth and cushioned with a layer of spongy cartilage. In addition, the joint contains a highly viscous fluid that lubricates the articular surfaces. In a dog with normal hips, all of these factors work together to cause the joint to function smoothly and with stability.



Hip dysplasia is associated with abnormal joint structure and a laxity of the muscles, connective tissue, and ligaments that would normally support the joint. As joint laxity develops, the articular surfaces of the two bones lose contact with each other. This separation of the two bones within the joint is called a subluxation, and this causes a drastic change in the size and shape of the articular surfaces. Most dysplastic dogs are born with normal hips but due to their genetic make-up (and possibly other factors) the soft tissues that surround the joint develop abnormally causing the subluxation. It is this subluxation and the remodeling of the hip that leads to the symptoms we associate with this disease. Hip dysplasia may or may not be bilateral; affecting both the right and/or left hip.

What are the symptoms of hip dysplasia?

Dogs of all ages are subject to hip dysplasia and the resultant osteoarthritis. In severe cases, puppies as young as five months will begin to show pain and discomfort during and after exercise. The condition will worsen until even normal daily activities are painful. Without intervention, these dogs may eventually be unable to walk. In most cases, however, the symptoms do not begin to show until the middle or later years in the dog's life.

The symptoms are similar to those seen with other causes of arthritis in the hip. Dogs often walk or run with an altered gait. They may resist movements that require full extension or flexion of the rear legs. Many times, they run with a 'bunny hopping' gait. They will show stiffness and pain in the rear legs after exercise or first thing in the morning. They may also have difficulty climbing stairs. In milder cases dogs will warm-up out of the stiffness with movement and exercise. Some dogs will limp and many will become less willing to participate in normal daily activities. Many owners attribute the changes to normal aging but after treatment is initiated, they are surprised to see a more normal and pain-free gait return. As the condition progresses, most dogs will lose muscle tone and may even need assistance in getting up.

Who gets hip dysplasia?

Hip dysplasia can be found in dogs, cats, and humans, but for this article we are concentrating only on dogs. In dogs, it is primarily a disease of large and giant breeds. German Shepherds, Labrador Retrievers, Rottweilers, Great Danes, Golden Retrievers, and Saint Bernards appear to have a higher incidence, however, these are all very popular breeds and may be over represented because of their popularity. On the other hand, sighthounds such as the Greyhound or the Borzoi have a very low incidence of the disease. This disease can occur in medium-sized breeds and rarely in small breeds. It is primarily a disease of purebreds although it can happen in mixed breeds, particularly if it is a cross of two dogs that are prone to developing the disease.

What are the risk factors for the development of hip dysplasia?

Hip dysplasia is caused by a subluxation in the hip joint. This creates abnormal wear and erosion of the joint and as a result arthritis and pain develop. The disease process is fairly straightforward; the controversy starts when we try to determine what predisposes animals to contracting the disease.

Genetics: Researchers agree that hip dysplasia is a genetic disease. If a parent has hip dysplasia, then the animal's offspring are at greater risk for developing hip dysplasia. If there are no carriers of hip dysplasia in a dog's lineage, then it is highly unlikely he will not contract the disease. If there are genetic carriers, then he *may* contract the disease. We can greatly reduce the incidence of hip dysplasia through selective breeding. We can also increase the incidence through selectively breeding. We cannot, however, completely reproduce the disease through selective breeding. In other words, if you breed two dysplastic dogs, the offspring are much



more likely to develop the disease but the offspring will not all have the same level of symptoms or even necessarily show any symptoms. The offspring from these dogs will, however, be carriers and the disease will most likely show up in their offspring in later generations. This is why it can be challenging to eradicate the disease from a breed or specific breeding line.

Nutrition: It appears that the amount of calories a dog consumes and when in the dog's life those calories are consumed have the biggest impact on whether or not a dog genetically prone to hip dysplasia will develop the disease.

Experimentally, it has been shown that obesity can increase the severity of the disease in genetically susceptible animals. It stands to reason that carrying around extra weight will exacerbate the degeneration of the joints in a dog; including the hip. Dogs that may have been born genetically prone to hip dysplasia and are overweight are therefore at a much higher risk of developing hip dysplasia and eventually osteoarthritis.

Another factor that may increase the incidence of hip dysplasia is rapid growth in puppies during the ages from three to ten months. Experimentally, the incidence has been increased in genetically susceptible dogs when they are given free choice food. In one study, Labrador Retriever puppies fed free choice for three years had a much higher incidence of hip dysplasia than their littermates who were fed the same diet but in an amount that was 25% less than that fed to the free-choice group.

Feeding a diet that has too much or too little calcium or other minerals can also have a detrimental effect on the development of the hip joint. However, with today's complete and balanced dog foods this has become a rare occurrence. The practice of feeding home-made dog foods is popular with some dog owners. These diets must be carefully monitored for proper nutritional balance; not only for calcium and the other essential minerals but for all nutrients.

Exercise: Exercise may be another risk factor. It appears that dogs that are genetically susceptible to the disease may have an increased incidence of disease if they over-exercised at a young age. But at the same time, we know that dogs with large and prominent leg muscle mass are less likely to contract the disease than dogs with small muscle mass. So, exercising and maintaining good muscle mass may actually decrease the incidence of the disease. Moderate exercise that strengthens the gluteal muscles, such as running and swimming, is probably a good idea. Whereas, activities that apply a lot of force to the joint are contraindicated. An example would be jumping activities such as playing Frisbee.

How is hip dysplasia diagnosed?

The diagnosis of canine hip dysplasia is typically made by combining: clinical signs of arthritis and pain, a complete physical exam, and radiographs (x-rays). If a dog is showing outward signs of arthritis, there are usually easily recognized changes in the joint that can be seen on radiographs. In addition, the veterinarian may even be able to feel looseness in the joint or may be able to elicit pain through extension and flexion of the rear leg. Regardless, the results are straightforward and usually not difficult to interpret.

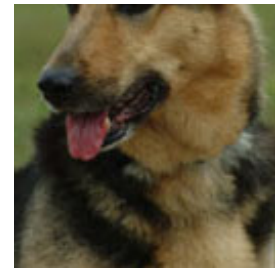
However, about half of the animals that come in for a determination on the health of their hip joints are not showing physical signs, but are intended to be used for breeding. The breeder wants to ensure that the animal is not at great risk for transmitting the disease to his or her offspring. There are two different testing methods that can be performed. The traditional is OFA testing. The other relatively newer technique is the PennHip method.

OFA: The method used by the Orthopedic Foundation for Animals (OFA) has been the standard for many years. The OFA was established in 1966, and has become the world's largest all-breed registry. The OFA maintains a database of hip evaluations for hundreds of thousands of dogs. Radiographs are taken by a local veterinarian using specific guidelines and are then submitted to the OFA for evaluation and certification of the dog's hip status. Since the accuracy of radiological diagnosis of hip dysplasia using the OFA technique increases after 24 months of age, the OFA requires that the dog be at least two years of age at the time the radiographs are taken. Because some female dogs experience additional hip subluxation when they are in heat, pregnant or nursing the OFA recommends that the evaluation should not be performed during these times.

To get the correct presentation and ensure that the muscles are relaxed, the OFA recommends that the dog be anesthetized for the radiographs. OFA radiologists evaluate the hip joints for congruity, subluxation, the condition of the acetabulum, and the size, shape, and architecture of the femoral head and femoral neck. The radiographs are reviewed by three radiologists and a consensus score is assigned based on the animal's hip conformation relative to other individuals of the same breed and age. The OFA then places the evaluated dogs into one of seven categories. Normal hips are graded as: excellent, good or fair. If the consensus is unclear the dog is graded as borderline dysplastic. And dogs with obvious radiographic signs of hip dysplasia are graded as: mild, moderate, severely dysplastic. Dogs with hips scored as borderline or dysplastic (mild, moderate, severe) are not eligible to receive OFA breeding numbers.

The OFA will also provide preliminary evaluations (performed by one OFA radiologist) of dogs younger than 24 months of age to help breeders choose breeding stock. Reliability of the preliminary evaluation is between 70 and 100% depending on the breed.

PennHIP: The diagnostic method used by the University of Pennsylvania Hip Improvement Program (PennHIP) uses unique radiographic views of the dog's hips to more accurately identify and quantify joint laxity. This program was conceived in 1983 and became a usable system by 1993. To assure quality and repeatability among diagnostic centers using the PennHIP technique, veterinarians must take a



special training course to become certified. Radiographs of the hips are taken with the dog under heavy sedation. These radiographs can be taken on a dog as young as 16 weeks. Two views are obtained with the hind limbs in neutral position to maximize joint laxity. These are known as the distraction and compression radiographic views. Weights and an external device are used to help push the head of the femur further into or away from the acetabulum. The amount of femoral head displacement (joint laxity) is quantified using a distraction index or DI. The DI ranges from 0 to 1 and is calculated by measuring the distance the center of the femoral head moves laterally from the center of the acetabulum and dividing it by the radius of the femoral head. A DI of 0 indicates a very tight joint. A DI of 1 indicates complete luxation with little or no coverage of the femoral head. A hip with a distraction index of 0.6 is 60% luxated and is twice as lax as a hip with a DI of 0.3. A third radiographic view is taken using the same positioning as the OFA. The "hip-extended" view is used to obtain additional information regarding the possible presence of degenerative joint disease (DJD) in the hip.



When the PennHIP DI was compared to the OFA scores for 65 dogs, all dogs scored as mildly, moderately, or severely dysplastic by the OFA method had a DI above 0.3.

Hip laxity as measured by the DI is strongly correlated with the future development of osteoarthritis. Hips with a DI below 0.3 rarely develop osteoarthritis. Although hips with a DI above 0.3 are considered "degenerative joint disease susceptible," not all hips with a DI greater than 0.3 will develop osteoarthritis. It is known that some hips with radiographically apparent laxity do not develop osteoarthritis. A means of differentiating lax hips that develop osteoarthritis from those that will not is important in developing a prognosis and making treatment or breeding recommendations. In one study, the DI obtained from dogs at four months of age was a good predictor of later osteoarthritis, though the 6 and 12-month indices were more accurate.

The PennHIP method has gained popularity and more and more veterinarians are becoming certified.

How is hip dysplasia treated surgically?

There are several surgical procedures available to treat hip dysplasia depending on the dog's age, body size, and the severity of the hip joint's degeneration.

Triple Pelvic Osteotomy (TPO): TPO is a procedure used in young dogs usually less than 10 months of age that have radiographs that show severe hip laxity, but have not developed damage to the joints. The procedure involves surgically breaking the pelvic bones and realigning the femoral head and acetabulum restoring the weight-bearing surface area and correcting femoral head subluxation. This is a major surgery and is expensive, but the surgery has been very successful on animals that meet the requirements.

Juvenile Pubic Symphysiodesis: A less invasive surgery for treating hip dysplasia is called Juvenile Pubic Symphysiodesis. This surgery prematurely fuses two pelvic bones together, allowing the other pelvic bones to develop normally. This changes the angle of the hips and improves the articulation of this joint, lessening the likelihood of osteoarthritis. Early diagnosis is critical, since the procedure must be done before 20 weeks of age, preferably 16 weeks, and before any signs of arthritis are evident.

Total Hip Replacement: This may be the best surgical option for dogs that have degenerative joint disease as a result of chronic hip dysplasia. Total hip replacement is a procedure that can produce a functionally normal joint, eliminate degenerative changes, and alleviate joint pain. The procedure involves the removal of the existing joint and replacing it with an artificial joint or prosthesis. To be a candidate for this procedure, the animal must be skeletally mature. With the new micro-prosthetics there is no minimum size limit. In addition, there is no maximum size limit. If both hips need to be replaced, there is a three-month period of rest recommended between the surgeries. As with the TPO surgery, this is an expensive procedure but it produces very good results. Most dogs return to a near normal level of activity without pain.

Femoral Head and Neck Excision: Femoral head and neck excision is a procedure in which the head of the femur is surgically removed and a fibrous pseudo-joint replaces the hip. This procedure is considered a salvage procedure and is used in cases where degenerative joint disease has occurred and total hip replacement is not feasible or if the expense of a total hip replacement is prohibitive. The resulting pseudo-joint will, in most cases, be free from pain and allow the animal to increase his activity, however, full range of motion and joint stability are decreased. For best results, the patient should weigh less than 40 pounds; however, the procedure may be performed on larger dogs.

How is hip dysplasia treated medically?

Medical management of hip dysplasia and osteoarthritis has greatly improved thanks to the introduction and approval of several new drugs. Because hip dysplasia is primarily an inherited condition, there are no products on the market that prevent its development. Through proper diet, exercise, supplements, anti-inflammatories, and pain relief, you may be able to decrease the progression of degenerative joint disease, but the looseness in the joint or bony changes will not change significantly.

Helping a dog maintain his recommended weight may be the

Because of the high cost involved with corrective surgeries, medical management is many times the only realistic option for pet owners. Medical management is multifaceted. For the best results, several of the following modalities should be instituted.

single most important thing an owner can do for their pet.

Weight Management: Helping a dog maintain his recommended weight may be the single most important thing owner can do for their pets. Surgical procedures and medical therapies will be far more successful if the animal is not overweight. You, as the owner, have control over what your dog eats. If you feed a quality food in an amount appropriate for your dog's size, breed and activity level and keep treats to a minimum, your dog should be able to maintain an ideal weight. Considering that more than half of the pets in the U.S. are overweight, there is a fair chance that many of the dogs with hip dysplasia/osteoarthritis are also overweight. If your dog is overweight, seek the advice of your veterinarian concerning a lower calorie dog food and an exercise program.



Exercise: Exercise is equally important in losing and/or maintaining the appropriate weight. Exercise that provides good range of motion and muscle building as well as limiting wear and tear on the joints is best. Leash walks, swimming, walking on treadmills, and slow jogging are excellent low-impact exercises. Bear in mind that an exercise program needs to be individualized for each dog based on the severity of the osteoarthritis, his weight, age, and physical condition. In general, too little exercise can be more detrimental than too much, however the wrong type of exercise can actually cause harm. While playing Frisbee can be very enjoyable and fun for the dog, it is extremely hard on his joints.

Remember, it is important to exercise *daily*; only exercising on weekends, for example, may cause more harm than good. Regular exercise in shorter sessions is always better than long work-outs on weekends. Warming the muscles prior to exercise and following exercise with a "warm-down" period are beneficial. Consult with your veterinarian regarding an exercise program appropriate for your dog.

Warmth and good sleeping areas: Most people with arthritis find that the symptoms tend to worsen in cold, damp weather. Keeping your pet warm, may help him be more comfortable. A pet sweater will help keep joints warmer. In addition, you may want to consider keeping the temperature in your home a little warmer.

Providing an orthopedic foam bed helps many dogs with arthritis. Beds with dome-shaped, orthopedic foam distribute weight evenly and reduce pressure on joints. They are also much easier for the pet to get out of. Place the bed in a warm spot away from drafts.

Massage and physical therapy: Your veterinarian or the veterinary staff can show you how to perform physical therapy and massage on your dog to help relax stiff muscles and promote a good range of motion in the joints. Remember, your dog is in pain, so start slowly and build trust. Begin by petting the area and work up to gently kneading the muscles around the joint with your fingertips using small, circular motions. Gradually work your way out to the surrounding muscles. Moist heat may also be beneficial.

Making daily activities less painful: Going up and down stairs is often difficult for arthritic dogs; it can make going outside to urinate and defecate very difficult. Many people build or buy ramps, especially on stairs leading to their yard, to make it easier for their dogs to go outside. Ramps also make car travel easier for arthritic dogs.



Oral Supplements

Glucosamine and Chondroitin: [Glucosamine and chondroitin](#) are two compounds that have been widely used to help manage osteoarthritis in both animals and humans.

Glucosamine is the major sugar found in glycosaminoglycans and hyaluronate, which are important building blocks in the synthesis and maintenance of joint cartilage in the joint. Chondroitin enhances the synthesis of glycosaminoglycans and inhibits damaging enzymes within the joint.

When a dog has hip dysplasia, the joint wears abnormally and the protective cartilage on the surface of the joint gets worn away and the resultant bone-to-bone contact creates pain. Glucosamine and chondroitin give the cartilage-forming cells (chondrocytes) the building blocks they need to synthesize new cartilage and to repair the existing damaged cartilage. These products are not painkillers; they work by actually healing the damage that has been done. These products generally take at least six weeks to begin to help heal the cartilage and most animals need to be maintained on these products the rest of their lives. These products are safe and show very few side effects. There are many different glucosamine/chondroitin products on the market, but they are not all created equal. Drs. Foster and Smith's line of Joint Care products or Cosequin are recommended.

Perna Mussels: [Perna canaliculus](#), or green-lipped mussel, is an edible shellfish found off the shores of New Zealand. The soft tissue is separated from the shell, washed several times, frozen, and freeze-dried. It is then processed into a fine powder

and added to joint care products. It is made up of 61% protein, 13% carbohydrates, 12% glycosaminoglycans (GAGs-an important component of connective tissue), 5% lipids, 5% minerals, and 4% water. It also contains glucosamine, a GAG precursor and one of the building blocks of cartilage. Glucosamine and GAGs are the compounds in the mussel believed to contribute to its beneficial effects.

Omega-3 Fatty Acids: [Omega-3 fatty acids](#) are often used for the management of the signs of atopy in dogs. Because of their anti-inflammatory properties, some have advocated their use in dogs with osteoarthritis.

Avocado/Soybean Unsaponifiables (ASUs): ASU's are an extract of avocados and soybeans. There is some very promising research that indicates that ASU's can help protect cartilage, support cartilage repair, and decrease the discomfort associated with osteoarthritis. ASU's are thought to enhance the action of glucosamine and chondroitin. ASU's are found in Doctors Foster and Smith Premium Joint Care 3.

Duralactin: Duralactin is a patented product obtained from the milk of grass-fed cows. It has been studied and marketed for the management of musculoskeletal disorders in dogs. This compound has anti-inflammatory properties and is available without a prescription.

It may be used as a primary supportive nutritional aid to help manage inflammation or in conjunction with non-steroidal anti-inflammatory drugs (NSAIDs) or corticosteroids.

Methyl-sulfonyl-methane (MSM): [MSM](#) is a natural, sulfur-containing compound produced by kelp. Sulfur is necessary for the production of collagen, glucosamine, and chondroitin. MSM is reported to enhance the structural integrity of connective tissue, and help reduce scar tissue by altering components that contribute to scar formation. MSM has been promoted as having powerful anti-inflammatory and pain reducing properties, and is thought to work by blocking the pain perception in certain nerve fibers before the pain impulse reaches the brain.

S-Adenosyl-L-methionine (SAME, Denosyl SD4): A recent product, Denosyl SD4, has been advocated for the management of osteoarthritis in people. The efficacy of this product for the management of osteoarthritis in animals has not been fully determined; however it is being used as a treatment for liver disease in dogs and cats. It has both anti-inflammatory and pain relieving properties.

Injectable Disease-Modifying Osteoarthritis Agents:

Polysulfated Glycosaminoglycan (Adequan): Adequan is a product that is administered as an intramuscular injection. A series of shots are given over four weeks and very often this product produces favorable results. This product helps prevent the breakdown of cartilage and may help with the synthesis of new cartilage. The complete mechanism of action of this product is not completely understood, but appears to work on several different areas in cartilage protection and synthesis. The cost and the inconvenience of twice weekly injections are a deterrent to some owners, especially with the ease of giving oral glucosamine products.

Hyaluronic Acid (Legend): Hyaluronic acid is an important component of joint fluid. Including it in the management of osteoarthritis may protect the joint by increasing the viscosity of the joint fluid, reducing inflammation and scavenging free radicals. Most of the research on hyaluronic acid has been done in people and horses, but it may also be beneficial in dogs. Because this product is injected directly into the joint and it is not labeled for dogs **its use must be under the direct supervision of a veterinarian.**

Anti-inflammatory Drugs:

Carprofen (Rimadyl), etodolac (EtoGesic), deracoxib (Deramaxx), firocoxib (Previcox), tepoxalin (Zubrin) meloxicam (Metacam): These are non-steroidal anti-inflammatory drugs (NSAIDs) developed for use in dogs with osteoarthritis. They are very effective painkillers that also reduce inflammation. They are prescription products and because of potential side effects, careful adherence to dosing quantity and frequency must be followed. The manufacturers recommend that patients taking these medications have a thorough physical examination along with appropriate blood-work (especially tests for liver health) performed before starting these medications. In addition, patients taking these products should be periodically monitored to make sure that they are tolerating the medication. These products are often used initially with glucosamine therapy and then as the glucosamine product begins to work, the NSAID dose may be reduced or even eliminated. NSAID's (including aspirin) should never be combined unless directed by your veterinarian. Acetaminophen (Tylenol), and ibuprofen (Advil) have many potential side effects and are **not recommended** without veterinary guidance.

Buffered Aspirin: Buffered aspirin is also an anti-inflammatory and painkiller used in dogs. It can be used along with glucosamine/chondroitin products. With all aspirin products used in dogs, there is a risk of intestinal upset or in rare cases, gastric ulceration. Using buffered aspirin formulated for dogs makes dosage and administration much easier. Do NOT give your cat aspirin unless prescribed by your veterinarian.

Corticosteroids: Corticosteroids have been used for many years to treat the pain and inflammation associated with



Never give human NSAID's to your pet without consulting your veterinarian.

osteoarthritis, however, their use is controversial. Corticosteroids act as a potent anti-inflammatory, but unfortunately, they have many undesirable short and long-term side effects. Because of these side effects and the advent of newer, more specific drugs, corticosteroids are generally only used in older animals with flare-ups where all other pain control products have failed. Corticosteroids are a prescription product and come in both a pill and injectable form.

How do we prevent hip dysplasia?

When it comes to preventing hip dysplasia, there is only one thing that researchers agree on; selective breeding is crucial. We know that through selectively breeding animals with certified hips, we can significantly reduce the incidence of hip dysplasia. We also know that we can increase the incidence of hip dysplasia if we choose to use dysplastic animals for breeding. Breeding two animals with excellent hips does not guarantee that all of the offspring will be free of hip dysplasia, but there will be a much lower incidence than if we breed two animals with fair or poor hips. If we only bred animals with excellent hips it would not take long to make hip dysplasia a rare occurrence. If owners insisted on only purchasing an animal that had parents and grandparents with certified good or excellent hips, or if breeders only bred these excellent animals, then the majority of the problems caused by hip dysplasia would be eliminated. For someone looking to purchase a dog, the best way to lower the possibility of getting an animal that develops hip dysplasia is to examine the incidence of hip dysplasia in the litter's lineage. It is best to examine the parents and grandparents out to three or four generations.

When it comes to preventing the formation of hip dysplasia, there is only one thing researchers agree on; selective breeding is crucial.

There are many different theories on how to prevent the progression of hip dysplasia. As discussed earlier, poor nutrition, inadequate or improper exercise, and increased body weight may all contribute to the severity of osteoarthritis after the hip dysplasia has developed. Following solid recommendations for exercise and nutrition may help, but will never come close to controlling or eliminating the disease if stricter requirements for certified hips are not instituted or demanded.

Summary

Hip dysplasia is a widespread condition that primarily affects large and giant breeds of dogs.

There is a strong genetic link between parents that have hip dysplasia and the incidence in their offspring. There are probably other factors that contribute to the severity of the disease.

Osteoarthritis of the hip is the result of the degeneration of the joint due to a laxity caused by hip dysplasia. Surgical and medical treatments are targeted to prevent and treat the resulting osteoarthritis. The best way to prevent hip dysplasia is through selection of offspring whose parents and grandparents have been certified to have excellent hip conformation.

Did you know people can get hip dysplasia too? For more information check out the International Hip Dysplasia Institute at <http://www.hipdysplasia.org>