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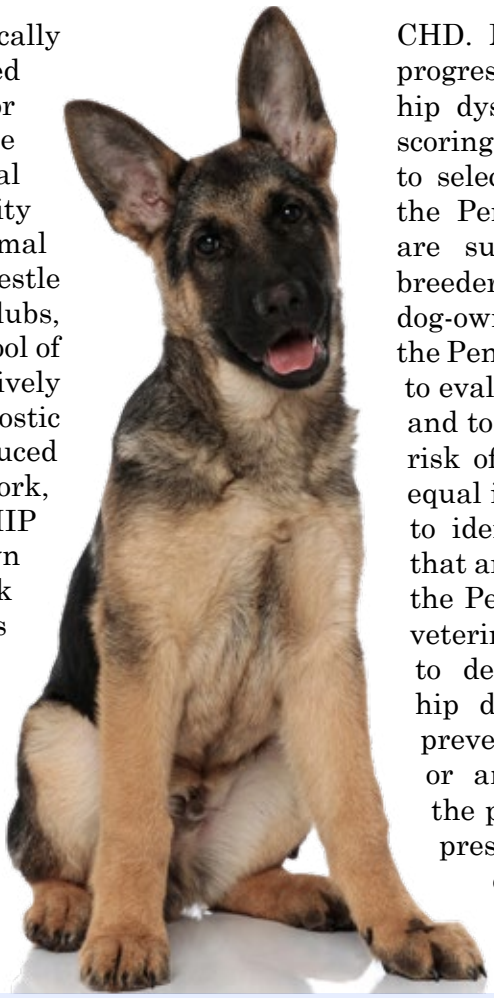
AIS ANTECH IMAGING SERVICES

# ANTECH IMAGING NEWS

## PennHIP Evaluation of Hip Dysplasia


**At 6 months, this dog's hips exhibit extreme laxity, but no OA. At 15 months, laxity is accompanied by the development of mild to moderate OA. The femoral heads appear slightly flattened, the femoral necks are beginning to thicken and the acetabular rims are in the early stages of remodeling. At six years, OA has progressed into a "severe" form, marked by extreme bony remodeling of the acetabular cups and the femoral head and necks. Cartilage has been eroded and bone is rubbing on bone.**

PennHIP was introduced clinically in 1993 as a science-based stress radiographic method for determining hip joint laxity and the development of OA. Funding for pivotal research came from The University of Pennsylvania, The Morris Animal Foundation, The Seeing Eye, Inc., Nestle Purina, Inc. and several breed clubs, among others. Since 1983, a large pool of research had accumulated to definitively establish the efficacy of this diagnostic method prior to its being introduced clinically in 1993. From this body of work, hip laxity as measured by the PennHIP distraction index has been shown to be the primary phenotypic risk factor predicting the osteoarthritis of CHD. This discovery is a major step forward in the understanding of the origins of CHD.



However, how you measure hip laxity is critical. Hip laxity appearing on the conventional VD hip-extended radiograph has not been shown to accurately predict the OA of CHD. Moreover, only marginal clinical progress in reducing the incidence of hip dysplasia has been made by using scoring of the hip-extended radiograph to select breeding dogs. The benefits of the PennHIP system for hip screening are substantial to veterinarians, dog breeders, dog trainers and the general dog-owning public. A major advantage of the PennHIP method is its proven efficacy to evaluate young dogs (16 weeks of age) and to predict with clinical accuracy the risk of developing OA later in life. Of equal importance, however, is its ability to identify those dogs with tight hips that are not at risk to develop OA. Using the PennHIP method of hip evaluation, veterinarians can test dogs early in life to determine the risk of developing hip dysplasia. With this information preventive measures to offset the risk or ameliorative measures to control the pain and disability of CHD can be prescribed. For future generations of dogs, time tested principles of quantitative genetics when

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combined with PennHIP laxity data represent a powerful tool for breeders to make real improvement in the hip quality of dogs.

**Dysplastic Hips**

The expression hip dysplasia can be interpreted as the abnormal or faulty development of the hip. Abnormal development of the hip causes excessive wear of the joint cartilage during weight bearing, eventually leading to the development of arthritis, often called degenerative joint disease (DJD) or osteoarthritis (OA). Today, the general veterinary consensus is that hip dysplasia is a heritable disease manifested as hip joint laxity that leads to the development of OA. So a knowledge of hip joint laxity is key to predicting the ultimate development of the OA of CHD.

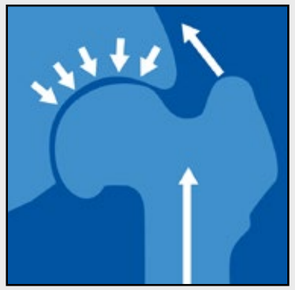
Hip dysplasia is a disease of complex inheritance, meaning it is caused by many genes and its expression can be affected by multiple non-genetic factors. Veterinarians and dog breeders have attempted to eliminate CHD through selective breeding strategies based on scoring of the standard hip-extended radiograph, however, the reduction of CHD frequency in pure-breed dogs has been disappointing.

**Defining Hip Laxity**

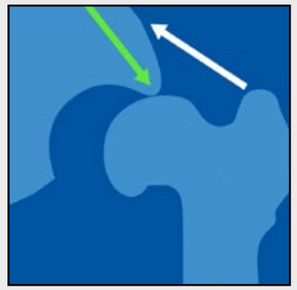
Hip joint laxity is the most important risk factor for the development of osteoarthritis./The amount of laxity or looseness in a hip joint is related to the chance that a hip will develop OA: the looser the hip, the greater the risk. For this reason, it is important to understand the difference between passive and functional hip laxity.

- Passive hip laxity is subjectively scored or measured on a hip radiograph of a dog while under heavy sedation or anesthesia. The PennHIP method measures passive laxity.
- Functional hip laxity is the pathologic form of laxity occurring during normal weightbearing in dogs with dysplastic hips. Current hip screening methods cannot assess functional hip laxity.
- PennHIP research has shown that passive hip laxity is a clinically useful surrogate for functional hip laxity.

Under normal conditions, the sum of the forces on the joint are spread out over a large surface area of cartilage. When laxity (or subluxation) is present in the joint, the force applied by the surrounding muscles actually increases to compensate for the laxity (see middle figure). The sum of the forces exerted on the dysplastic hip is greater than the sum of forces exerted on the normal hip. In addition, the forces on the dysplastic hip are applied over a smaller surface area (green arrow). The high joint contact stresses produce injury and ultimately result in the loss of delicate articular cartilage. Over time, functional hip laxity results in erosion of the femoral head and flattening of the acetabulum.



Normal Hip Mechanics



Effects of Hip Laxity

Result of Hip Laxity







**Measuring Hip Joint Laxity**

PennHIP uses a unique method, an index, to measure hip joint laxity. The method is quantitative (i.e., it assigns a number to joint laxity) as opposed to being qualitative or subjective (e.g. excellent, good, fair, etc.). The index is not as vulnerable to inter- and intra-observer errors commonly associated with subjective measurement systems.

The index method is calculated by digitally superimposing precision circle gauges on the cortical margins (rims) of the acetabulum and femoral heads to identify the respective geometric centers. On the compression view (Figure 1), if the joint is free of osteoarthritis, the centers of the acetabulum and femoral head should coincide indicating that the joint is indeed concentric. On the distraction view (Figure 2), the distractive force causes separation between the centers. The distance, d, between the centers is a measure of hip joint laxity. However, d also varies with dog size (larger dogs would likely have larger d's than smaller dogs), with growth of the dog from puppy to adult, and with magnification due to variation in hip-to-film distance. To circumvent these potential sources of variation, d is normalized with respect to the size of femoral head and acetabulum by dividing it by the radius of the femoral head, r. The resulting index, Distraction Index = d/r, is a unitless number ranging from 0 to 1 (or more). The laxity index computed for the compression view is called a compression index (CI), likewise, the laxity index for the distraction view is called the distraction index (DI).

The distraction index is a measurement of hip joint laxity. It does not allude to a passing or failing score. Hips with DIs on the distraction view that are less than 0.3 are considered to be tight, while DIs close to 1 are considered to be extremely loose.


**Figure 1: Compression View**

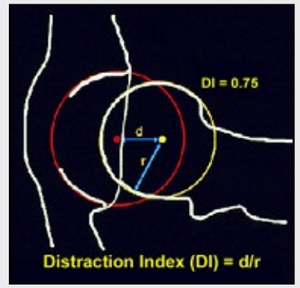
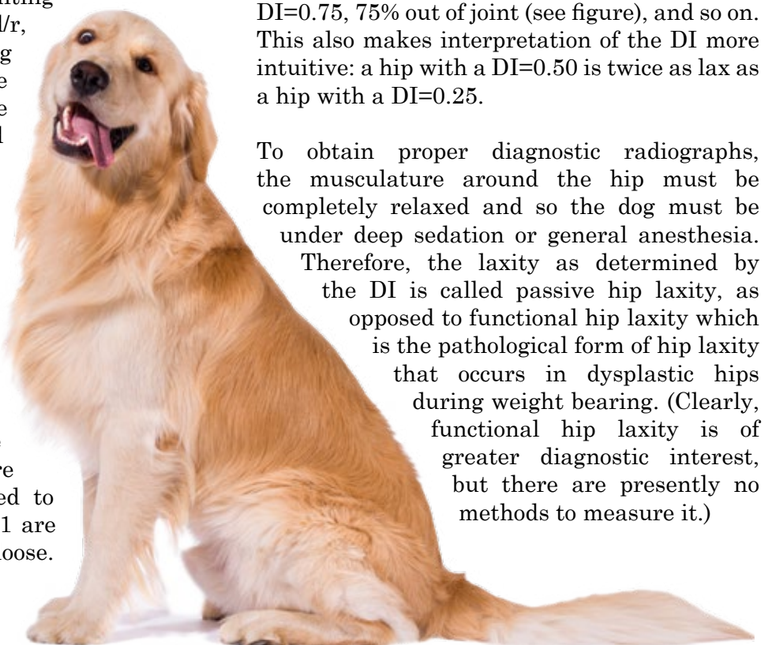



**Figure 2: Distraction View**

The DI is an indication of the "percent out of joint" that the femoral head is displaced from the acetabulum. For example, DI=0.58 means the femoral head comes out of the joint by 58%, DI=0.75, 75% out of joint (see figure), and so on. This also makes interpretation of the DI more intuitive: a hip with a DI=0.50 is twice as lax as a hip with a DI=0.25.

To obtain proper diagnostic radiographs, the musculature around the hip must be completely relaxed and so the dog must be under deep sedation or general anesthesia. Therefore, the laxity as determined by the DI is called passive hip laxity, as opposed to functional hip laxity which is the pathological form of hip laxity that occurs in dysplastic hips during weight bearing. (Clearly, functional hip laxity is of greater diagnostic interest, but there are presently no methods to measure it.)



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## Evaluation of the Three Views

### Hip-extended View

The dog's hind legs are placed in "extension." PennHIP utilizes the hip-extended view to identify radiographic signs of osteoarthritis. (Figure 1)

Traditional hip screening methods rely solely on the hip extended view to evaluate both the presence of hip arthritis and joint laxity (subluxation). Using traditional systems this dog's hips would be considered normal because the hip-extended view shows no evidence of arthritis or subluxation (laxity).

While the hip-extended view can detect existing arthritic changes, it often conceals hip laxity thereby giving a false impression of joint tightness. So, in the absence of arthritic changes, as in this dog, the hip-extended view does not reliably distinguish between dogs that are disease-susceptible and those that are not.

### Compression View

The dog's hind legs are positioned in a neutral, weight bearing orientation and the femoral heads (balls of the femur) are gently seated into the acetabula (Figure 2). This view can identify critical anatomic landmarks of the hip and determine how well the femoral head fits into the acetabulum.

### Distraction View

The dog's hind legs are positioned in the same neutral position as the compression radiograph and a special device is used to reveal the dog's inherent joint laxity. This exclusive feature of the PennHIP procedure permits accurate measurement of maximal hip laxity. (Figure 3)

When comparing this dog's hip-extended view (Figure 1) to the distraction view (Figure 3), the distraction view reveals much greater joint laxity. The PennHIP method uses the amount of joint laxity revealed in the distraction view (Figure 3) to tell us that this dog is actually susceptible to developing hip dysplasia and will likely show radiographic evidence of hip arthritis later in life.



**Figure 1: Hip-extended View**

**Figure 2: Compression View**

**Figure 3: Distraction View**

AIS PennHIP



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## How to become PennHIP Certified

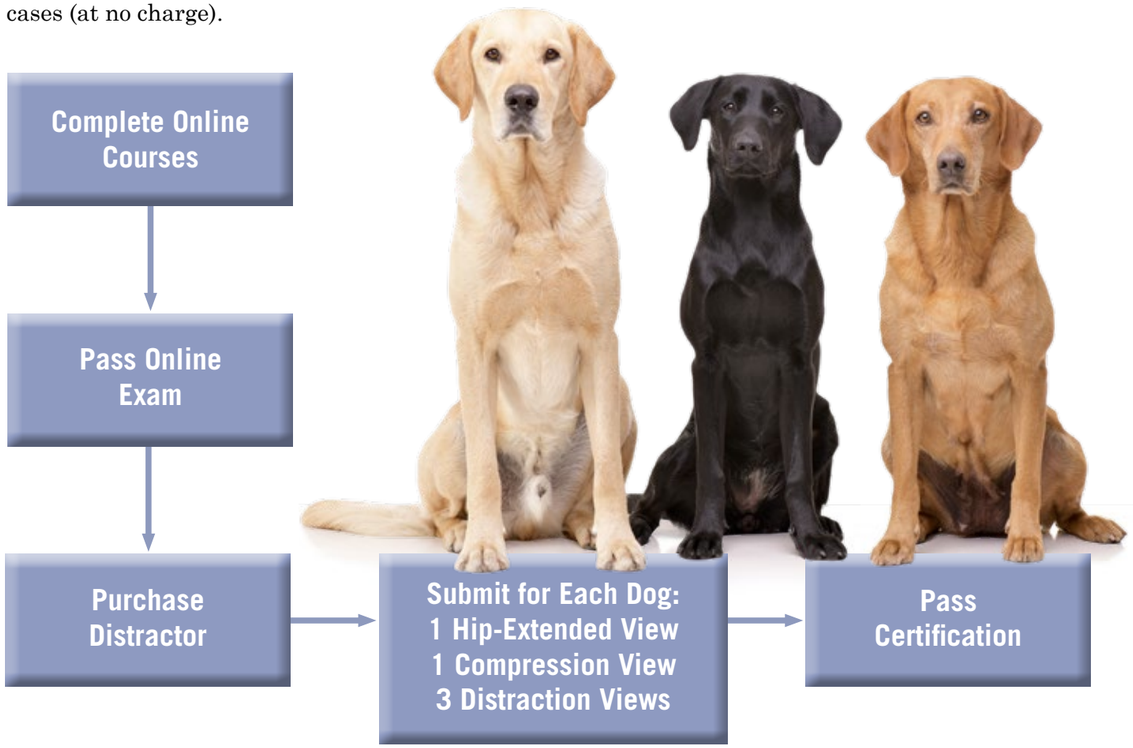
Training to perform the PennHIP procedure competently has been one of the principles responsible for PennHIP's success. To become a member of the AIS PennHIP network requires taking the new online course and passing the exam at the end, followed by successful completion of certification exercises at your practice.

### Online Training

Online training consists of 5 modules. The 5 modules must be completed within 14 days of registering. The course modules total only 2 hours and can be easily completed within one day or less. Upon viewing the online training modules and passing the online exam, RACE credits will be issued.

### Certification

Certification is the final step in training. You will need to purchase the PennHIP distractor in order to submit 3 test cases to show proficiency in performing the AIS PennHIP method. There is no charge to process the certification radiographs if submitted within 45 days of passing the online course. You may submit as many dogs as needed within the 45-day period to attain 3 "passing" cases (at no charge).




**For up-to-date information on the expanding pool of scientific documentation of the PennHIP method including comparisons to other methods, visit the PennHIP web site at:**
**antechimagingservices.com/antechweb/pennhip**

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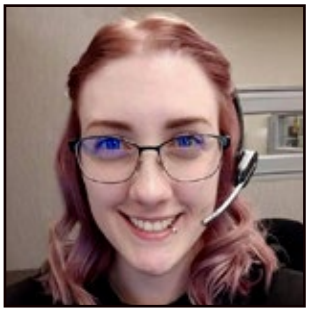

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## We Wish You a Happy New Year & Look Forward to Many Years of Working Together!

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