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Evaluation for canine hip dysplasia in Golden and Labrador retrievers using PennHIP method in Korea

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Abstract : Hips of the Golden and Labrador retrievers in Korea were evaluated with the University of Pennsylvania Hip Improvement Program (PennHIP) and the severity of joint laxity and degenerative joint disease (DJD) were compared to the PennHIP database. The distraction index (DI) of domestic Golden and Labrador retrievers was significantly higher than the DI of the PennHIP database. In the two breeds, the prevalence of DJD increased according to the DI. However, the severity of DJD did not show a positive correlation with the DI. Overweight dogs and dogs kept indoors showed more severe DJD and more prevalence of clinical signs. This report is thought to be the first case presentation of a large population of Golden and Labrador retrievers in Korea and the findings are representing the overall level of canine hip dysplasia (CHD) of domestic Retrievers, as the PennHIP method was not available in Korea until 2001. We can respect that the stock of retrievers can have a tighter hip joint through control of CHD using an accurate diagnostic method keyed to a phenotype especially concern for joint laxity using PennHIP method and an organized screening program. The clinical manifestation of dysplastic dog can be reduced through control of bodyweight and the environment with regular monitoring the hips with concern for joint laxity using PennHIP method.

Keywords : canine hip dysplasia, degenerative joint disease, distraction index, Pennsylvania Hip Improvement Program

This study was performed to estimate the prevalence of canine hip dysplasia (CHD) of domestic Golden retrievers (GR) and Labrador retrievers (LR) using the University of Pennsylvania Hip Improvement Program (PennHIP) and to evaluate the effects of joint laxity, gender, environment and body weight on the development of degenerative joint disease (DJD) and clinical signs. Eighty-seven retrievers (GR = 58 and LR = 29), inspected with the PennHIP examination at the Haemaru Referral Animal Hospital from 2001 to 2005, were selected. Definitive information about signalment, environment, and clinical signs were included and the dogs that had systemic or other orthopedic disease were excluded from the study. There was no distinction of gender (female = 56, male = 31) in animal selection and all dogs were over 4-months old. After fasting over 12 h, the general condition of each dog was checked with a blood examination including CBC and serum chemistry and then the dog was anesthetized with tiletamine/zolazepam (Zoletil; Virvac, France). The PennHIP examination, including a hip extended view, compression view and distraction view, was performed (Fig. 1). Hip extended view was obtained in neutral position according to previous method. DJD was evaluated from a hip-extended view. On ventrodorsal position, the femur was positioned perpendicular to table and tibia and fibula were positioned to perpendicular to femur. Distraction view was obtained when hip joint was distracted with specific device. Distraction view was used to quantitative measurement of hip joint laxity. Compression view was obtained while external force was loaded to hip joint to fit the femoral head into the acetabulum for evaluation of the congruity of hip joint. Each radiograph was submitted

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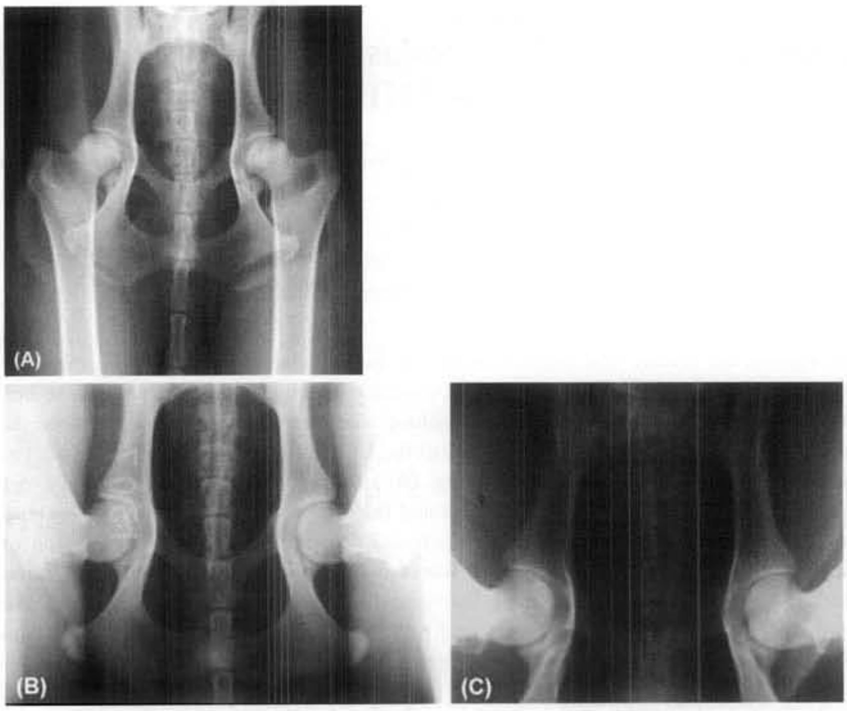

Fig. 1. University of Pennsylvania Hip Improvement Program examination of hip joint. (A) Hip extended view, (B) distraction view, and (C) compression view.

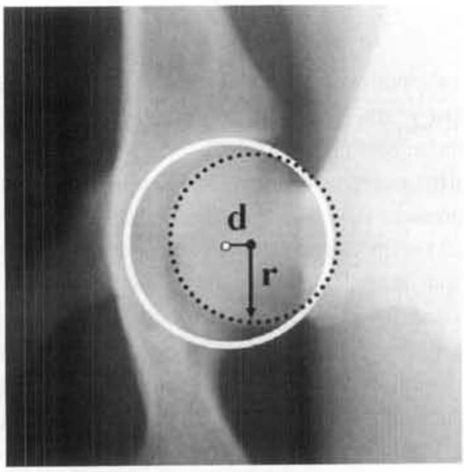

Fig. 2. Diagram measuring distraction index (DI) on the distraction view. Each circle indicates margin of the acetabulum (white line) and femoral head (dotted line). To calculate DI, distance (d) between the centers of two circles is divided by the radius of femoral head (r). DI is a unitless number from 0 to 1.

to the PennHIP analysis center (USA) and was evaluated for the distraction index (DI), which provides an quantitative assessment of hip joint laxity as a unitless number from 0 to 1 and the severity of DJD as none, mild, moderate or severe [8, 13] (Fig. 2).

The median DI of GR (0.67) in this study was significantly higher than DI of GR (0.54) which was derived from the PennHIP database ($p < 0.05$). The median DI of LR (0.48) in this study was significantly higher than DI of LR (0.52) which was derived from the PennHIP database ($p < 0.05$). The DI of LR was significantly lower than that of GR ($p < 0.05$), as analyzed by the independent t-test, and this result corresponds to the PennHIP database. For each dog, the left and right DIs were not significantly different as determined by the student's paired t-test ($p > 0.05$).

All dogs were classified into four graded groups according to the DI grade (grade 1, < 0.3; grade 2, 0.3–median DI; grade 3, median DI–0.7; grade 4, > 0.7) (Table 1). The median DI was different according to breed, which was achieved from the PennHIP database as mentioned previously. A DI value of 0.3 has been established in part as a susceptibility threshold value for DJD [3]. In each group of dogs, the incidence of DJD showed a positive correlation with DI grade ($p < 0.05$) (Fig. 3). However, the severity of DJD was

Table 1. The number of Golden and Labrador retriever according to the grade of distraction index (DI)

	Grade 1	Grade 2	Grade 3	Grade 4
Golden retriever (n = 58)	0	13	19	25
Labrador retriever (n = 29)	1	7	19	3

DI was classified into four grade i.e. grade 1; < 0.3, grade 2; 0.3~median DI in the breed, grade 3; median DI~0.7, grade 4; > 0.7.
Median DI derived from PennHIP database; 0.54 for Golden retriever and 0.48 for Labrador retriever.

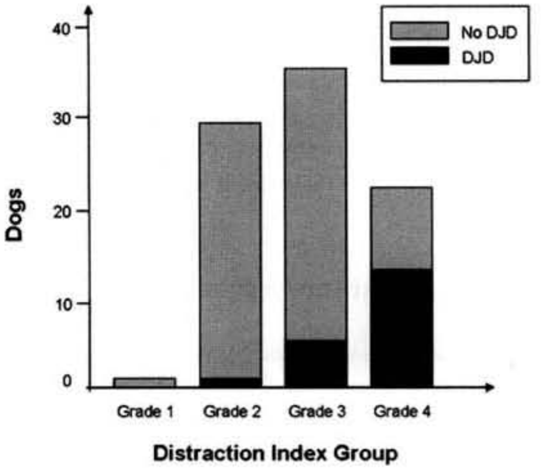

Fig. 3. The correlation between distraction index (DI) and degenerative joint disease (DJD). DI was classified into 4 grades. i.e., grade 1 < 0.3, grade 2 < median DI, grade 3 < 0.7, and grade ≥ 4 0.7.

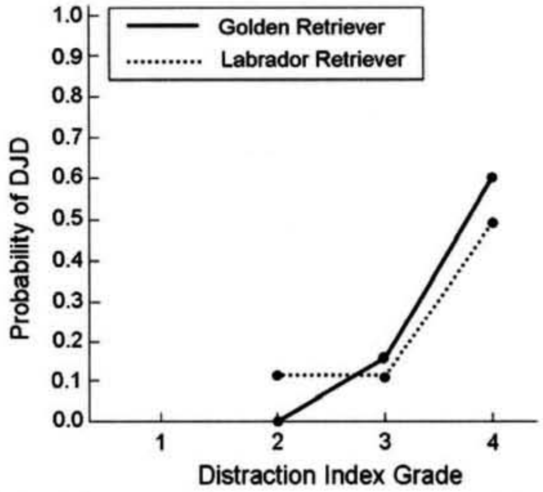

Fig. 4. Breed specific degenerative joint disease (DJD) probability based on distraction index (DI) for Golden and Labrador retrievers. DJD developed higher in Golden retriever than in Labrador retriever in the same DI grade.

not consistent with the DI grade. For the same DI grade, GR tended to have a higher proportion of DJD development than LR ($p < 0.05$) (Fig. 4), and this result was in agreement with a previous reports [7, 10]. For example, German shepherds were reported 6.3 times as likely to develop DJD as Rottweilers with the same DI scores [7]. Therefore, estimation for the probability of DJD according to the breed plays an important role in a diagnostic procedure [10].

CHD can be confirmed in a dog that has been classified with DI grade 4 or any grade with a DJD lesion [1, 10]. In this study, 28 GR and 5 LR were confirmed as having CHD and the median DI of each breed was 0.89 and 0.60, respectively. The clinical signs of CHD were evaluated based on owner observations for changes in locomotion, behavior, and demeanor associated with hip joint diseases; these criteria have been used in a number of studies as being reliable for the identification of chronic pain [2]. Eleven of 28 dysplastic GR were symptomatic and the DI of these symptomatic GR (DI = 0.76) was significantly higher than the DI of the non-symptomatic GR (DI = 0.60) as determined by the independent *t*-test ($p < 0.001$). However, 11 dysplastic GR and all of the dysplastic LR showed no clinical signs, and there was no significant positive correlation between the prevalence of DJD and clinical signs ($p > 0.05$). It is generally accepted that the extent of pain of an animal cannot be predicted from the pathological changes on radiographic finding only [2]. Therefore, bodyweight, gender and environment were evaluated in dysplastic GR to investigate whether the additional clinical factors influence the clinical signs or not. The bodyweight is usually diverse in young dogs, so in the dogs older than 1 year (n = 22), the bodyweight was divided into four groups: 25-30 kg, 30-35 kg, 35-40 kg and > 40 kg. The effect of bodyweight on DJD development and clinical signs, respectively, were analyzed with ANOVA. There was a significant positive correlation of bodyweight for DJD and clinical signs ($p < 0.05$). This result is in agreement with a previous experimental study that indicated that overfeeding has proven to be detrimental for hip dyaplasia [8]. The prevalence of DJD and clinical signs according to gender were not significantly different as determined by statistical analysis with the use of the Pearson Correlation ($p > 0.05$). Environment was divided into indoor (n = 13) and outdoor (n = 15), and the influence of growing environment on DJD and clinical signs were analyzed by the dependent sample t-test. Pets kept indoors showed a higher prevalence of DJD than pets kept outdoors ($p < 0.05$) and the dogs kept indoors had a tendency to show more clinical signs than dogs kept outdoors, though the finding was not highly statistically significant. The environmental effect on development of DJD and clinical signs have not been investigated in previous studies, but an epidemiological study reported that playing with other dogs might also be a risk factor for joint disease in dogs [9]. It can be assumed that a slippery environment causes more load and stress on the hip joint just like playing with other dogs.

This study has a limitation that the clinical signs were not evaluated quantitatively but only classified as yes or no. Therefore, the severity of clinical signs according to DI, bodyweight, and environment were not investigated.

Joint laxity is an essential factor for CHD and leads to development of DJD. There has been no organized screening and filtering system developed by veterinarians, breeders and pet owners in Korea; therefore, the overall percentage of loose hip joints may be estimated higher than from the PennHIP database [3]. Genetic control of CHD requires (a) an accurate diagnostic method based on a phenotype with optimal heritability, (b) an organized screening program based on the diagnostic phenotype, (c) a centralized data-base containing essential phenotypic and pedigree information, and (d) trust and cooperation between breeders and the veterinarians who conduct the diagnostic procedure [4, 5]. Therefore, selection for better hip joint conformation on the basis of the DI will yield more rapid genetic progress in lowering the prevalence of CHD in Korea [3]. Recently, a lot of studies which focused on genetic structure of susceptibility traits for CHD and mapping quantitative trait loci (QTLs) have been performed to identify the genetic etiology of CHD [6, 12]. CHD has polygenic inheritance, therefore QTLs can be identified to help map regions of the genome that contain genes involved in specifying a quantitative trait and it can be an early step in identifying and sequencing these genes. PennHIP is a good screening test for CHD and can evaluate CHD on the basis of a reliable database containing large population of dogs in each breed. However, it requires a specified certification and time-consuming to get the result. There are several other useful radiographic methods such as dorsolateral subluxation (DLS) radiographs [5, 11]. DLS can be used as a prompt and a reasonable screening method for identification of dogs with CHD. CHD is a hereditary disease, but several factors, such as bodyweight and the growing environment, can affect the manifestation of this disease. The clinical signs of a dog with CHD can be controlled with adjustment of these factors in practice.

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