A Picture is Worth a Thousand Words: Radiographic Screening for Canine Hip and Elbow Dysplasia

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Outline:

- Dysplasia overview
- Radiographic Screening Tests
  - Hip Dysplasia
    - OFA
    - PennHip
  - Elbow Dysplasia
    - OFA

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Dysplasia

- Inherited developmental disease of bone
- Dypslasia = Abnormal formation
  - Greek word Dys=abnormal and Plassein = Form
- Nature ***and*** Nurture
  - Polygenic genetic disease
  - Complex mode of inheritance
  - Disease expression influenced by environmental factors

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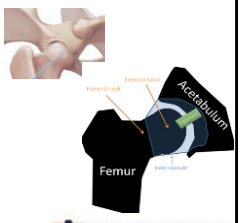
Hip development

- Femoral head and acetabulum are covered with articular cartilage
- Thin layer of synovial fluid
- Multiple structures stabilize joint
  - Ligament of the femoral head
  - Dorsal acetabular rim
  - Joint capsule
- Muscles encase the entire hip structure



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Hip dysplasia = Joint Laxity

Abnormal wearing of the hip joint

Osteoarthritis

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Prevalence of Hip Dysplasia

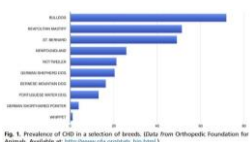

Fig. 1. Prevalence of CHD in a selection of breeds. (Data from Orthopedic Foundation for Animals. Available at: http://www.ofa.org/stats_hip.html.)

- Overall prevalence is unknown
  - 3.5%-19.7%
- Variable prevalence between breeds
- Reported prevalence within breeds is also often variable
- May be underestimated
  - Submission not mandatory
  - Limitations to OFA screening

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Clinical Signs:

- First signs typically between 3-15 months of age
- Variable signs
  - Exercise intolerance to severe lameness
  - Trouble getting up, trouble with stairs, morning stiffness, wobbly gait, bunny hopping.
  - Sometimes can appear as an acute injury because the hip joint is weak.

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Radiographic Screening

Health Tested Parents For Healthier Puppies

OFA
THE CANINE HEALTH INFORMATION CENTER

PennHIP

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OFA Process

- 24 months of age for registry number
- Properly positioned radiograph
  - Single image
  - Extended ventrodorsal view

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OFA Process

- Properly identified radiograph
- Properly exposed radiograph
- Chemical restraint recommended
- Avoid submitting OFA radiograph of females during estrus/pregnancy

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OFA Process

- Once submitted will be screened by radiologists for diagnostic quality.
- Will be sent back for retake if…
  - Poor positioning
  - Poor technique (too light, too dark)
  - Patient motion
- After radiograph deemed good diagnostic quality, it is reviewed by 3 boarded radiologists.
  - Each evaluation is independent.
  - Consensus of the three evaluations is formulated

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OFA Process

- After radiograph deemed good diagnostic quality, it is reviewed by 3 boarded radiologists.
  - Each evaluation is independent.
  - Consensus of the three evaluations is formulated.
  - Dysplastic results are not in the public domain unless consent is given by the owner of record.

Excellent Hips

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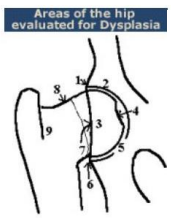
OFA Process



1. Craniolateral acetabular rim
2. Cranial acetabular margin
3. Femoral head (hip ball)
4. Fovea capitis (normal flattened area on hip ball)
5. Acetabular notch
6. Caudal acetabular rim
7. Dorsal acetabular margin
8. Junction of femoral head and neck
9. Trochanteric fossa

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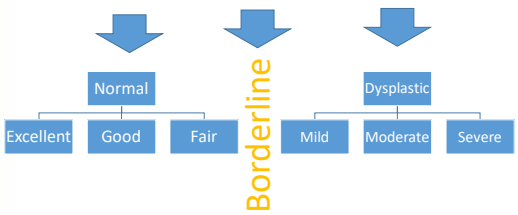
OFA Report



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OFA Report

Normal

Excellent
Superior hip conformation compared to other animals of the same breed and age

Good
Most common normal grade. Slightly less than superior but well formed congruent hip joint

Fair
Minor irregularities in the hip. The joint is wider than a good hip.

*All grades of normal are given an OFA number which is accepted by AKC for dogs with permanent identification and results made public.

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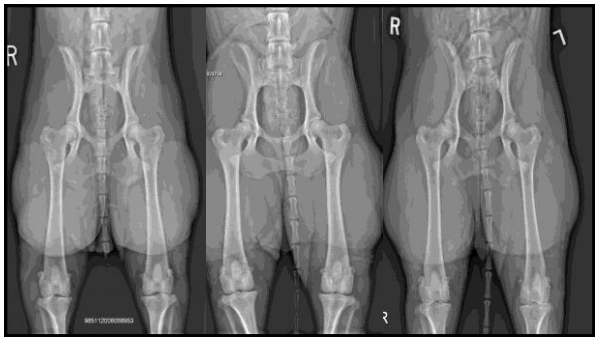

OFA Report

Dysplastic

Mild
Significant subluxation. No DJD. If 24-30 months, option to re evaluate when older. Usually will remain dysplastic.

Moderate
Significant subluxation with shallow sockets. DJD present.

Severe
Marked DJD and subluxation

***Dysplastic results are not in the public domain unless consent is given by the owner of record.**

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OFA Report

Borderline

No clear cut consensus between radiologists to place in normal or dysplastic category.
More incongruent than "Fair" but no DJD.
Recommend repeat films in 6 months.
Initial and repeat films will be compared to assess for progressive arthritic changes.
> 50% that are initially borderline exhibit no change and will receive a normal (fair) grade.

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PennHIP

- Developled by University of Pennsylvania in 1993
  - Screening tool to evaluate laxity in the hips
  - Looser hips=higher risk of DJD/dysplasia
- Can be evaluated at 16 wks old
- Quantitative
  - Distraction Indexx (DI)

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PennHIP

- 3 views in the PennHip process
  - Hip Extended view
    - Same as for OFA
  - Compression view
  - Distraction view
- Requires sedation or anesthesia
- Personnel must be certified by PennHIP

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Hip extended view

- Same view as OFA
  - Used to evaluate for DJD
  - This view tends to reduce hip laxity

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Compression Radiograph

- Legs are positioned in a neutral orientation
  - Hips are seated into the socket
  - Used to look at how well the femoral head fits into the acetabulum

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Distraction View

A distraction device is used to measure laxity

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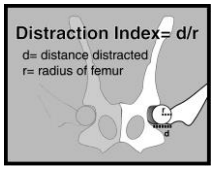
PennHIP

- Distraction Index (DI)
  - Distance the ball can be displaced from the socket
  - Number from 0-1
    - 1=high degree of laxity
    - 0=no laxity
    - Threshold value has been set at 0.3
      - <0.3 DJD is unlikely to occur



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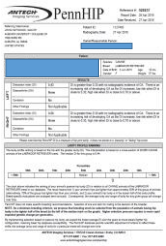
PennHIP

- Whats in the PennHIP report?
  - DJD
  - Distraction Index (DI)
  - Laxity profile ranking
    - **BREED SPECIFIC**



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RESULTS			
LEFT	Distraction Index (DI)	0.43	DI is greater than 0.30 with no radiographic evidence of OA. There is an increasing risk of developing OA as the DI increases; low risk when DI is close to 0.30, high risk when DI is close to 0.70 or above.
	Osteoarthritis (OA)	None	
	Cavitation	No	
	Other Findings	Not Applicable	
RIGHT	Distraction Index (DI)	0.56	DI is greater than 0.30 with no radiographic evidence of OA. There is an increasing risk of developing OA as the DI increases; low risk when DI is close to 0.30, high risk when DI is close to 0.70 or above.
	Osteoarthritis (OA)	None	
	Cavitation	No	
	Other Findings	Not Applicable	

Please note that the PennHIP DI is a measure of hip joint laxity. It does not allude to a "passing" or "failing" hip score.

LAXITY PROFILE RANKING

The laxity profile ranking is based on the hip with the greater laxity (DI). This interpretation is based on a cross-section of 28,068 CANINE animals of the LABRADOR RETRIEVER breed. The median DI for this group is 0.44.

Percentiles

90th	80th	70th	60th	50th	40th	30th	20th	10th
> 90th				Median				< 10th

The chart above indicates the ranking of your animal's passive hip laxity (DI) in relation to all CANINE animals of the LABRADOR RETRIEVER breed in our database. This result means that 1) your animal's hips are tighter than approximately 30% of this group of animals (alternatively, 70% of the group has tighter hips than your animal), and 2) your animal's hip laxity is in the looser half of the laxity profile. Breed-specific evaluations are analyzed semi-annually. Consequently, the average laxity and range of laxity for any given group will change over time.

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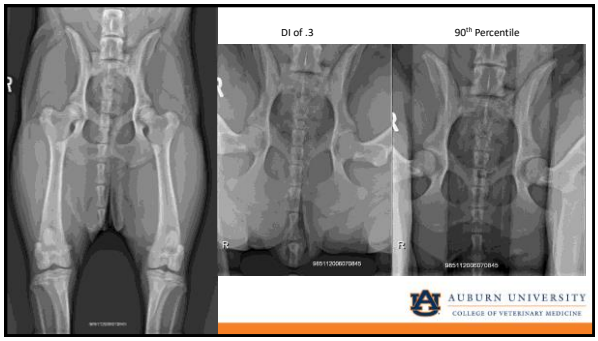

PennHIP

- Correlation between DI and DJD
  - In general, >DI = greater laxity = incr. risk for DJD
  - BUT BREED SPECIFIC
  - PennHIP recommends breeding dogs that have a DI = or > 60th percentile for their breed

    AND

    No evidence of DJD

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PennHIP vs OFA

- PennHIP-Quantitative
  - Min age 16w
  - 3 views
  - DVMs must be certified
  - Objective assessment -DI
  - Submission mandatory
  - Database private
- OFA-Qualitative
  - Min age is 2y
  - 1 view
  - Any DVM can perform
  - Subjective assessment – 7 grades
  - Submission voluntary
  - Database public
  - Requires owner permission to publish dysplastic results
  - Less cost

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PennHIP vs OFA

- PennHIP - Quantitative
- Heritability of DI is high
- DI <0.3 are at little to no risk of developing DJD
- Greater scientific support
- OFA - Qualitative
- Results are based on DJD

Both methods are trying to accomplish the same results:

Reduce the incidence of hip dysplasia

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Elbow Dysplasia

- General term used to identify inherited elbow disease of dogs
  - Fragmented medial coronoid process (FCP)
  - Ununited anconeal process (UAP)
  - Osteocondrosis (OC/OCD)
  - Elbow incongruity

*These conditions may occur alone or in combination

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Elbow Dysplasia

- Causes:
  - Polygenic inherited
  - OCD
  - Asynchronous growth
  - Combination?
- Common in large and giant breeds
- Usually both elbows affected
- As with HD, joint instability will result in DJD

- Clinical Signs:
  - Lameness of varying degrees

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Diagnosis

- Radiographs
  - Requires 3-4 views to accurately evaluate the elbow
- Computed Tomography (CT)

Remodeling of the proximal surface of the anconeal process (thick arrow, top) and sclerosis in the area of the trochlear notch (thin arrow).

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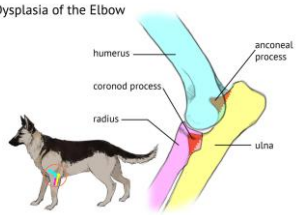
Dysplasia of the Elbow



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Medial Coronoid Process

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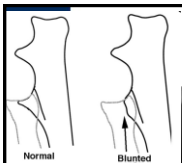
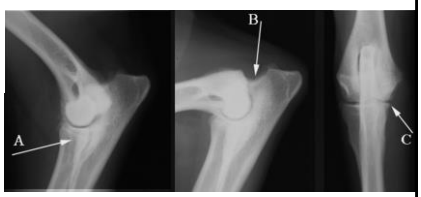


FCP



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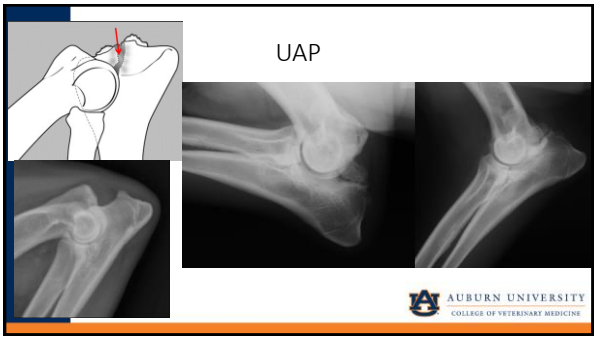
UAP



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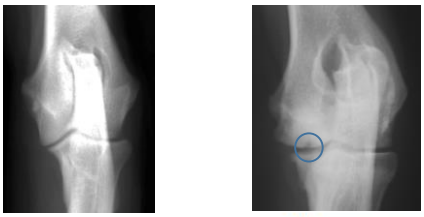
OCD



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Elbow dysplasia screening
OFA

- Single flexed lateral view of the elbow required but can send additional views
  - Looking for signs of DJD
    - Changes on the anconeal process
    - Sclerosis in the trochlear notch
- Certified at 24 months of age
  - Younger dogs can have preliminary evaluation

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OFA Report

Normal

Abnormal

Grade 1

Mild DJD Osteophyte < 2mm in height

Grade 2

Moderate DJD Osteophyte = 2-5mm in height

Grade 3

Severe DJD Osteophyte > 5mm in height

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OFA-Grade 3

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OFA

- Pitfalls:
  - Presence of DJD and clinical signs do not correlate directly
  - Potential to miss lesions?
- Recommendations - Just like hip dysplasia
  - Breeder should strive to breed normal dogs, from normal parents and grandparents

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