PROCEEDINGS

24rd annual meeting of the

INTERNATIONAL ELBOW WORKING GROUP

Monday July 20th, 2009
Transamerica Hotel
Sao Paulo, Brasil

Welcome to the 24th meeting of the I.E.W.G.

Elbow dysplasias (EDs), including at least five different entities, are recognised in an increasing number of dogs in Europe, in North and South America, in South Africa and Australia. EDs are especially recognised in the most popular dog breeds since Tigari published his findings in the mid-1970's. In 1989 the International Elbow Working Group (IEWG) has been established by veterinarians and breeders with great concern for this disabling skeletal disease, in order to form a platform to exchange knowledge, experiences, and scientific data. The IEWG provides a screening program for breeds at risk for EDs, which is used in many countries, thus facilitating uniform judging systems, transparency for all people involved, and making international trading of dogs more secure.
A breed can be considered a subgroup of the canine species because favoured characteristics have been selected by breeding among a small pool of dogs. The existence of breed related diseases suggests there is a genetic cause and many diseases are the consequence of stringent selection. Many groups have considered a genetic cause of different entities of EDs, especially fragmented coronoid process (FCP). Ubbink et al.(1998) reported the clustering of FCP in a particular cohort of Labrador Retrievers rather than its dissemination throughout the entire population, with affected animals descending from a few common ancestors. The high prevalence of FCP and elbow dysplasia in male dogs is thought to be weight related. The heritability (h^2) for ED differs between investigated cohorts, the different entities of EDs, and the different breeds. Also the manifestation of FCP in different breeds differs considerably with a loose apex of the medial coronoid in Bernese Mountain dogs and a loose fragment detached from the lateral side of the medial coronoid process kept in place by the radius, as seen in Labradors and Rottweilers. This demonstrates that even FCP is most probably not the same disease in different dog breeds. The same count true for elbow incongruity. The understanding of the etiology of these entities and their molecular genetic background will finally help to erase these diseases. The IEWG forms a platform for exchange ideas and results of research for a joined effort to fight the disease, as well as to come to better diagnostic procedures and treatment techniques to help the dogs who are suffering from EDs.
The IEWG, appointed as an affiliate of the World Small Animal Veterinary Association (WSAVA), has its annual meeting preferably in conjunction with the annual WSAVA-congress. The IEWG is privileged that the organising committee of the ANCLIVEPA BRASIL/ WSAVA 2009 congress in Sao Paulo offered their hospitality to allow the 24th IEWG-meeting to take place as a pre-WSAVA-congress meeting. This makes it possible for IEWG to be in contact with veterinarians of the South American countries and exchange ideas on the most relevant aspects of ethiology, pathophysiology, therapies (including discussions on joint denervation, and elbow arthrotomy and arthroscopy for removal or reattachment of loose particles) and actual screening programmes regarding elbow dysplasias.
The Board of the IEWG is grateful to Dr. Richard Nap that he was willing to co-organise the meeting, to chair the session, to present two lectures and to read radiographs according to the IEWG system. In addition, our gratitude goes to the other main speakers Dr. Ross Palmer and Dr Gabriel Ramirez, as well as to Dr. Zamprogno. We thank Dr Marianna Lamberts for her support to the meeting and Hill's Pet Nutrition for support and the public relations of the meeting to the national veterinarians. Dr. Helia Zamprogno (Portugese) and Dr.Gabriel (Spanish) kindly offered to help with translations. On behalf of the participants, the IEWG-Board thanks them for that!

On behalf of the Board of IEWG and the sponsor Hill's Pet Nutrition, I welcome the participation of veterinarians of all countries both at the seminar of IEWG during the world congress as at the webpage of IEWG (www.iewg-vet.org **)** in order to reach the goals of IEWG and thus diagnose, treat and abandon elbow dysplasia in our dog populations.

Herman A.W. Hazewinkel, DVM, PhD
President of the I.E.W.G.

The International Elbow Working Group acknowledges the financial support by

HILL'S PET NUTRITION

PROGRAMME IEWG 2009
SAO PAULO MEETING

Monday 20th July 2009
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08.30 – 09.00 hrs	Registration
09.00 hrs	Welcome Dr. Marianna Lamberts & Dr. Helia Zamprogno
	Elbow dysplasia, definition and known aethiologies Dr. Richard C. Nap
	Pathofysiology of elbow incongruency Dr. Gabriel Ramirez
	The clinical relevance of elbow denervation in pain management Dr. Helia Zamprogno
	Arthrotomy and arthroscopy of the canine elbow joint Dr. Ross H. Palmer.
	Screening programme for Elbow Dysplasia Dr. Richard C. Nap
12.30 – 14.00 hrs	Lunch
14.00 – 15.30 hrs	Film reading session
15.30 hrs	General discussion
16.00 hrs	Closure

List of speakers

Dr. Richard C. Nap, DVM, PhD, Dipl. ECVS and Dipl. ECVCN
Uppertunity Consultants, www.uppertunity.com
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Elbow dysplasia, definition and known aetiologies

Prof. Dr. Herman A.W. Hazewinkel, DVM, Ph.D, Dipl. ECVS, Dipl. ECVCN
Dr. Richard C. Nap, DVM, PhD, dipl. ECVS

Introduction

Elbow dysplasias (ED) occur frequently in 4-6 months old dogs of medium and large body size, during the period of high growth velocity. Since developmental skeletal diseases, either due to genetic disease or due to nutritional influences or trauma, are frequently seen in this category of companion animals all three can be held responsible for the occurrence of ED. It is known that each form of ED will lead to osteoarthrosis (OA) with possibly severe consequences for the well-being of the animal and its owner. Therefore great effort has been undertaken by different research groups to elucidate the etiology of ED to come to guidelines how to prevent their occurrence. First the definitions will be given of the primary entities of ED as well as of the different grades of osteoarthrosis (OA). Second, the different aspects involved in these heritable elbow diseases will be reviewed.

Definitions

Originally the term "elbow dysplasia" or "*dysplasia articulationis cubiti*" covered generalized osteoarthrosis of the elbow joint with an ununited anconeal process (UAP) (Corley et al, 1968). Now UAP is just one of the different entities which are covered by the term "ED", which is here defined as the group of elbow dysplasias including 1) ununited anconeal process (UAP), 2) fragmented medial coronoid process (FCP), 3) osteochondrosis (OC) or osteochondritis dissecans (OCD), and 4) incongruity (INC) of the elbow joint. These four entities have in common that they all occur in the elbow joint (although OCD occurs also in other joints), that they are all seen in young growing dogs (although they can be overlooked) of medium and large size, that they can cause lameness (but not in all cases and not for the first time only in young dogs), and that they will cause osteoarthrosis (but that can vary per individual dog and perhaps even per breed).

Primary lesions

These lesions can be graded as absent (ED grade 0), suspected-present (ED grade II) or present (ED grade III). We distinguish the following primary lesions:

1. UAP: Separation in the cartilaginous bridge between the secondary ossification centre of the anconeal process and the olecranon, resulting in (can cause a) partially or completely detached anconeal process, referred to as ununited anconeal process (UAP)

2. FCP or MCPD (= medial coronoid process disease): Fissuring of the medial coronoid process of the ulna with partial to complete separation (fragmentation) of the medial coronoid process from the ulna; primary a subchondral bone lesions with secondary cartilage changes (Guthrie et al, 1992), although also *chondromalacia* at the medial coronoid process is considered part of this entity.

3. OC: Local thickening of growing epiphyseal cartilage with delayed endochondral ossification, which may develop into OCD with a single or fragmented detached cartilage flap.

“Kissing lesion”: An abrasion of the articular cartilage, sometimes extending into the subchondral bone (radiologically often slightly more lateral than the OC-lesion), and here caused by a fragmented coronoid process (Morgan et al, 2000). This finding is graded as a OCD-like lesion.

4. Elbow incongruity (EI, INC): The subchondral bone of the trochlear notch of the ulna and of the radial head are not parallel to the opposing humeral subchondral bone. There are different forms of EI:
The radius longer than the ulna with a narrowing of the joint space between the tip of the anconeal process and the humeral condyle, a distally gradual widening of the joint space between the ulnar semilunear notch and the humeral condyle and the radial head proximal of the coronoid process of the ulna
The longer ulna with a wider joint space between the proximal radius and the humeral condyle and the step between the more proximally located distal edge of the ulnar trochlear notch (i.e., the lateral coronoid process) and the radial head (and displacement of the distal humerus cranially). This can also be considered as an underdeveloped or too small trochlear notch.
The alignment between the subchondral bone of the trochlear notch and the radial head is more elliptical than the circular contour of the humeral condyles described by Wind (1986)
Developmental elbow luxation with lateral displacement of the (often hypoplastic) radial head with a comparative overgrowth of the radius (as seen in chondro-dysplasia in non-chondrodystrophic breeds)

5. Osteoarthrosis is radiologically characterized by new bone formation at the edges of the joint. In addition, enthesophytes (i.e. new bone formation at the sites of attachments of tendons, ligaments, and joint capsule, resulting from abnormal tension placed on the soft tissue attachments near the joint margins) can be formed.
Regardless of the primary cause, the pattern of OA is similar. The different locations where osteophytes and enthesophytes are visible in case of OA are given in Fig. 1.

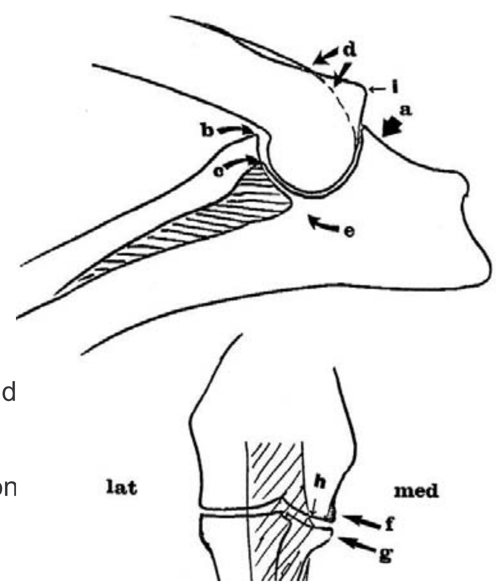

Fig. 1 Locations for grading of elbow OA

a. the proximal surface of the anconeal process
b. the cranial aspect of the radial head
c. the cranial edge of the medial coronoid process

d. the caudal surface of the lateral condylar ridge
e. sclerosis of the ulnar notch, at the base of the coronoid
f. on the medial surface of the medial epicondyle
g. at the medial edge of the medial coronoid process
h. indentation of the subchondral bone: OCD (-like) lesion

Grading of Elbow Osteoarthrosis (OA)
Borderline OA (B) can be defined as increased radiographic density (sclerosis) in the ulna caudal to the trochlear notch. In addition, minimal changes at the dorsal border of the anconeal process which is considered as a normal edge and grouped under border line. This can be scored separately or as Grade 1 (see table 1)

Grading definitions:
Grade 0 OA: no signs of osteophytosis or osteosclerosis
Grade I OA: When at any of the locations listed a – i. osteophytes are present of < 2 mm, or presence of osteosclerosis
Grade II OA: When at any of the locations listed a-i osteophytes are present of 2-5 mm.
Grade III OA: When at any of the locations listed a-i osteophytes are present of ≥5 mm.

Table 1 Scoring for ED making use only of the OA-score

Scoring for Elbow Dysplasia		Radiographic Findings
0	Normal elbow joint	Normal elbow joint, No evidence of incongruency, sclerosis or arthrosis
1	Mild arthrosis	Sclerosis of ulnar trochlear notch and/or Step > 2 mm between radius and ulna and/or Presence of osteophytes < 2 mm high
2*	Moderate arthrosis	Presence of osteophyte 2 - 5 mm high
3*	Severe arthrosis	Presence of osteophytes > 5 mm high

(B) "Borderline" between score 0 and 1 is allotted to undetermined cases reflected as minimal joint remodelling (in some countries).

In several countries the presence of a primary lesion such as UAP, FCP, OCD, or INC of > 2 mm, automatically results in a ED score 3; the *suspicion* of primary lesions results in a ED score 2 (see table 2).

6. Sclerosis.
An alteration in normal bone architecture, i.e., a decrease in normal bone porosity, is depicted on a ML view of the elbow joint as an increase on bony opacity with loss of trabecular markings (a white area), in the trochlear notch just caudal to the lateral coronoid process. Osteosclerosis is considered as one of the first signs of ED in young dogs, especially when the primary cause can not be identified as in some cases of FCP. This area can be compared with a control radiograph of the non-affected elbow in case of unilateral ED. However, since FCP often occurs bilaterally, the use of the opposite elbow joint will not be of help. In a survey with 17 Labrador retrievers (6-16 months of age) with FCP and 17 without FCP as diagnosed by arthroscopy, radiographic density was objectivated and expressed as pixels: an extremely significant correlation between pixel intensity of the projection of the lateral coronoid process revealed in dogs with FCP (Burton et al, 2007). Microscopically, this area is characterised by reduced intertrabeculae

spaces (Wolschijn et al, 2004), either due to mechanical overloading or influence of MMPs, enzymes which play a role in osteoarthrosis.

Imaging techniques

Radiographs play a major role in the diagnosis of ED, both in a clinical setting, to determine the phenotype in case of (DNA-)research as well as in screening the population. “More views will give more insight” counts also true in case of radiological investigation, especially in case the primary lesion is of importance to know. According to a large study in 447 Bernese Mountain Dogs by Lang et al (1998), 12% of them had a primary ED without OA yet. Therefore, screening for ED in Bernese Mountain dogs should include at least two perpendicular views. This seems especially true in breeds where OCD is anticipated to be the primary cause of ED (table 3).

In case the secondary signs only are of importance, a limited number of views can be sufficient. In addition to the ML and AP views, other views have been developed including ML view with 15 degree supination (exorotation) of the antebrachium (Voorhout et al, 1987), distomedial-proximolateral oblique view (Haudiquet et al, 2002). A FCP can be detected more accurately using computerized tomography (Tromblee et al, 2007), possibly ultrasonography (Knox et al, 2003), and certainly magnetic resonance imaging (MRI) (Snaps et al, 1997). The latter revealed the highest accuracy (95.5%), sensitivity (100%), and negative-predictive value (100%) for mineralised FCPs and on average 10% less for non-displaced, non-mineralized FCPs (Snaps et al, 1997), whereas CT revealed a accuracy of 86.7%, a sensitivity of 88.2% and a negative predictive value of 84.6% (Carpenter et al, 1993). Linear tomography and arthrography did not add much to findings of plain radiology (Carpenter et al, 1993). In case of occult cause of lameness, bone scintigraphy can point to the area of bone pathology including FCP with high sensitivity without invasive technique (Schwarts et al, 2004)

Table 2. The ‘Osteoarthrosis (OA) score’ schedule plus the ‘Primary cause’ schedule help to come to the ‘final ED score according to the IEWG’.

Osteoarthrose

OA	**0**	**I**	**II**	**III**
Localisation (fig.1) \ mm	0	<2	2-5	>5
A				
B				
D				
F				
G				
Architecture				
C	**–**		**+**	
E	**–**	**+**		
OA score				

Primary cause

ED	**0**	**2**	**3**
	–	±	+
UAP			
FCP			
OCD(-like) [h]			
INC			

Final ED score according to IEWG

O	NORMAL
1	INC > 2 mm Osteophytes < 2 mm Sclerosis

2	Osteophytes 2-5 mm Suspect (±) of primary cause
3	Osteophytes > 5 mm Positive for primary cause

Etiologies

Genetic influences

Purebred dog populations represent genetically closed populations, in which high selection intensities and subsequent high levels of consanguinity are common. When only few of the members of the breed (e.g. mainly the champions) are used for reproduction, then a genetic bottle-neck is created unintentionally but surely, reducing the genetic heterogeneity. It is to be expected that this selection procedure, which is common place in many breeds, may lead to increasing incidence of genetic diseases when the selected breeding stock by chance carried the genetic risk factor for ED or any other genetic disease. When the genetic risk factor has a dominant inheritance pattern leading to clinical signs before breeding age, then the dog and its parent(s) can be discarded from reproduction, like in chondrodysplasia (Carrig et al, 1988). But in case the genetic risk factor has a recessive or polygenetic inheritance pattern, has a variable pattern in penetration, or is based on a genetic diseases with a high influence of environmental aspects then, especially when manifest at older age, the entity has all chances to spread around in the population before being recognised. This is especially so, when there is a lack of adequate disease registration. In such diseases, the spread of the disease allele can be considerable before these diseases are recognised as genetic diseases within certain breeds (Ubbink 1998, Patterson et al, 1989).

Although ED occurs in well described breeds (Table 3), not each form of ED is seen in all of them:

Incongruity of the elbow joint (INC) can be caused by a variety of causes as clearly reviewed by Samoy et al (2006) and Gemmil et al (2007). Some incongruity of the joint is considered as normal, with the radius bearing 51-52% of the weight (Mason et al, 2005). INC due to an ulnar overgrowth is seen in 80% of the Bernese Mountain dogs with osteoarthrosis in the elbow joint. In a survey of a large group of Bernese Mountain dogs this type of incongruity was seen in all cases with elbow lameness in conjunction with a fragmented coronoid process (Ubbink et al, 1999). Population analyses revealed that the disease was introduced right after WW II by a limited number of founding fathers into the breed.

Fragmented coronoid process of the medial aspect of the ulna is seen in many breeds and in large percentages, up to 50% of the screened population (Svenson et al, 1997, Ubbink et al, 1999). The heritability estimates ($h^{2)}$ are between 0.24-0.43 for Bernese Mountain Dogs, 0.77 for Labradors and 0.45 for Golden Retrievers (Guthrie and Pidduck, 1990). For Retrievers, these figures are for osteochondritis dissecans of the medial humeral condyle (OCD) plus FCP, and thus found to be polygenetic in addition to multifactorial (Padgett et al, 1995), although there is enough evidence to conclude that FCP and OCD are two different, independently inherited entities (Padgett et al, 1995, Janutta et al, 2006). For FCP and OCD alone, h^2 has not been calculated yet.

The ununited anconeal process (UAP). It is seen in chondrodystrophic breeds (like Bassets) and as part of elbow incongruity in certain breeds (German Shepherd, St Bernard) as well as due to nutrition or traumatic induced radius curvus syndrome (Hazewinkel, 1998). Although often not easy to recognise, in dogs with an UAP a FCP can coincide as was reported by Meyer-Lindenberg et al (2006) in 16% of the cases of UAP. In a survey in 520 German Shepherd dogs in France, FCP was diagnosed in 11.3% of the cases, INC in 16,3% and UAP only in 1.1% of the dogs (possibly due to pre-screening), whereas combinations were seen in 42.2% of the joints with ED (Remy et al, 2004).

Table 3 Breed susceptibility for 3 entities included in Elbow Dysplasia

Fragmented coronoid process	OCD	UAP
Bernese Mountain Dog (140)	Newfoundland (261)	Bernese Mountain Dog (50)
Irish Wolfhound (93)	Rottweiler (174)	Rottweiler (27)
St Bernard (53)	Labrador (109)	Mastiff (20)
Mastiff (48)	Great Dane (87)	Newfoundland (14)
German Shepherd (44)	Golden Retriever (42)	Labrador (9)
Bullmastiff (39)		German Shepherd (8)
Rottweiler (36)		Golden R. (5)
Labrador (20)		

odds ratios given in brackets (LaFond et al, 2002)

When different entities of ED are not differentiated, ED has been proven to be polygenetic (Kirberger et al, 1998). It has been shown in Swedish breeding programmes that based on massive screening for ED and open registration of the results, the prevalence of OA due to ED decreases due to a decrease in incidence of the primary causes of OA (Swenson et al, 1997). Cluster analysis of one breed, using computerized programmes containing all pedigrees of the investigated population, reveals histograms representing a group of related dogs with 1/8 th of the genome in common. We evaluated Labrador Retrievers, Bernese Mountain dogs and Golden Retrievers in groups, non-selectively chosen from the Dutch population and representative for that population. All dogs were screened radiologically for FCP on 4 radiographs according to the technique described by the IEWG on their web page. Certain related groups revealed members positive for FCP in 27- 50% of the investigated dogs. These positive dogs are spread over the country so the environment (i.e., housing, rural vs town area) are different in many cases. In Labradors the affected groups were quite related and less related with non-affected groups, whereas in Bernese Mountain dogs all groups of 1/8th-related dogs were affected with ED and all groups were connected which each other at the 8th generation (born just after 1945); in Golden Retrievers ED was seen frequently in related groups and these groups were related with each other, although to a lesser grade as was seen in Labradors (Dijkshoorn et al, 2005). Although this method does not show the inheritance pattern, it is proven to be an effective method for persuading kennel clubs to take measurements like the obligation of screening before breeding.

DNA-analysis focussed on collagen candidate genes in Labradors with FCP, did not reveal any indication of the involvement of these candidate genes in this skeletal disease. Genome wide scan, using 300 polymorphic markers was expected to be more promising with the possible abnormal locus at the first and thirteenth chromosome, although it did not indicate affected alleles yet (Salg et al. 2006). Linkage analysis (i.e., determining the region of the genome containing the disease locus) limits the studies of candidate genes. Fine mapping might lead to the affected allele. Since FCP is unique in the canine species, it is unlikely that alleles mapped in other species may be of help. High density mapping and association studies may stimulate the molecular genetic studies in elbow dysplasia. Eventually, it is to be expected that DNA-analysis of the population will detect dogs with the affected gene(s) which did not express the disease (due to optimal environmental circumstances) or are heterozygous for the disease. DNA-analysis of the potential breeding stock will fore come a lot of frustration for breeders who now experience affected offspring of phenotypically normal parent dogs and thus a slow decrease of the incidence of these hereditary diseases in next generations.

Environmental influences

The expression of hereditary diseases can be influenced by environmental factors; like in hip dysplasia in German Shepherds where the heritability estimates were h^2=0.3, demonstrating the high influence of environmental factors (Distl et al, 1991). The h^2 for ED in Rottweilers (which may include all possible entities of ED, see Table I) is 0.31 $\pm$ 0.04 with detectable improvement in case of a breeding programme (Mäki et al, 2000). Not too much is known of heritability estimates for FCP and other EDs (see 'genetic influences'), but the h^2 seems to be higher, i.e., environmental influences are lower in ED than in HD. The penetrance of FCP in Labradors is higher in males than in females, at least 2:1 in Labradors (Salg et al, 2006) or in mixed populations (Carpenter et al, 1993).

From the heritability estimates of <0.5, it can be concluded that other factors may play a significant role in the manifestation of ED. From different studies it became clear that breeding with ED-negative dogs (based on radiological screening) will decrease the incidence of ED considerably when compared with breeding of positive x positive, or positive x negative, or negative x unknown (Svenson et al 1997). ED in Labradors (and in Golden Retrievers to a lesser extend) is seen more frequently in male than in female dogs, although it can be expected that environmental factors do not differ to such a degree between genders. We calculated that, in case ED follows the hereditary pattern of a variability in expression of a major, dominant gene, the penetration of FCP in male Labradors is 70% and in female dogs is only 28%. In other words, in a Labrador with the disease allele for FCP, this disease is expressed in 70% of the males and only in 28% of the females, thus a phenotypical negative female has a higher chance to pass the affected genes to the next generation than a negative male Labrador, even when screened carefully. For breeders this is important information, since it warrants not only the screening of the breeding stock, but also of related animals (i.e. littermates) and offspring, which might tell more about the genetic make-up of a particular dog than the radiograph of its own elbow joints.

Nutritional influences

From a variety of studies it became clear that nutrition has a major impact on skeletal development. Food with a high calcium content has proven in field studies (Slater et al, 1992, Kallfelz & Dzanis, 1989) as well as in standardised laboratory circumstances (Schoenmakers et al 1999, Schoenmakers et al 2000) that high mineral intake will cause disturbances in endochondral ossification. This makes the skeleton more vulnerable to mechanical influences like overweight as well as to OCD lesions and possibly chondromalacia. More recently, it became clear that vitamin D intake increased to a level that it will not lead to hypervitaminosis D (with calcification of soft tissues), will also disturb endochondral ossification by direct influence and not by increasing intestinal calcium absorption (Tryfonidou et al, 2002). High food intake and thereby excessive calcium and vitamin D intake does also lead to osteochondrosis (Lavelle 1989, Hedhammar et al, 1974). High calcium or high vitamin D intake will cause retained cartilage in growth plates and thus a disturbance of growth in length of the fast growing growth plates, in particular of the distal ulna and distal radius. Disturbance of growth in length may lead to radius curvus syndrome or short radius syndrome, respectively. Elbow incongruity in case of radius curvus syndrome may coincide with UAP, whereas incongruity with a shortened radius may coincide with FCP.

Secondary ossification centres (like the anconeal process) ossify via the process of endochondral ossification, whereas the coronoid process develops exclusively by appositional ossification (Breit et al, 2004). In large breed dogs the completion of ossification takes longer than in small breed dogs, for the coronoid process this is 20 weeks vs. 14 weeks of age, respectively (Breit et al, 2004). Dogs raised on food with a calcium excess have disturbed endochondral ossification and will take more time to complete the ossification process (Voorhout et al, 1985), despite undisturbed increase in body weight, which makes the softer cartilage protuberances more vulnerable to damage.

Nutritional imbalances (like calcium of vitamin D excess) will not cause skeletal disturbances in dogs which are not genetically predisposed to develop these disturbances (Nap et al, 1993).
These findings are of great value for owners of a single dog, who want to prevent ED to develop in their pet by providing an optimal environment to mature. A high quality dog food prepared particularly for puppies of large breeds should be provided, characterized by a lowered calcium content (~1.0% calcium of dry matter base) and a controlled vitamin D content (~500 IU/ kg food). It has been shown that an increased protein level of high quality, typical for the better puppy diets, does not have a negative influence on skeletal development whereas it is of importance for soft tissue growth and immunological defence systems (Nap et al, 1993).
In conclusion, the different entities of ED are caused by genetic and environment influences; one of the latter may be nutrition. However, dietary influences come only to expression when the genetic vulnerability is there, i.e. when the h^2 is between 0 and 1.

Mechanical influences
Traumatic injury of growth plates, especially Salter Harris type V fractures, may disturb growth in length of either the radius or the ulna, and as such may be responsible for the overloading of ulna or radius, respectively. In case the coronoid is mainly cartilaginous or the anconeal process is still separated from the olecranon by a cartilaginous layer (< 5 months of age), this can result in a FCP or UAP, respectively. Only seldom, there can be an indication of a traumatic fracturing of the anconeal process or of a coronoid process in adult dogs, while both age and history will differ from that of ED in young, fast growing dogs. Meyer-Lindenberg et al describe 263 lame dogs with arthroscopically confirmed FCP in total 332 affected joints and in 5 lame dogs a FCP without any radiological signs of OA in dogs >3 years of age; these 2% might have suffered a traumatic fragmentation of the coronoid, or the FCP has caused minimal arthritic changes (Meyer-Lindenberg et al 2002).
Not too much is known yet about the influence of loading on skeletal development in dogs. It is known that unloading will cause both disuse osteoporosis as cartilage degradation, especially in young fast growing individuals. Some of most compelling evidence that supports a causal relationship between cartilage function and form comes from animal experiments in which the joint loading is either increased or decreased above normal levels. Increasing the functional loading of joints through moderate exercise causes an increase in articular cartilage thickness, proteoglycan content, and mechanical stiffness of the tissue, though strenuous exercise can lead to the formation of cartilage lesions (Wong & Carter, 2003). In a large, well controlled study in fowls it became clear that a functional adaptation of joint cartilage to weight bearing occurs during the first months of life and is important for the development of resistance to injury during later life (Brama et al, 1999). Immobilization or other means of joint unloading has lead to a thinning and softening of the uncalcified part of articular cartilage, an increase in subchondral vascular eruptions, and a decrease in proteoglycan content. The structural and biochemical changes associated with joint unloading can only partially be reversed when the joint is remobilised. Physiologic joint loading results in functional adaptations that increase the resistance of the cartilage and are beneficial to the overall health of the tissue. The areas of enriched proteoglycan content are logically the areas most resistant to the degenerative changes that beset a joint during osteoarthritis (Wong & Carter, 2003).
Further research is needed to learn more about the optimal weight bearing or training activities of young, fast growing dogs to develop optimal functional adaptation. Some joint incongruity is considered as normal in non-arthritic elbow joints, increasing with increasing body weight (Janach et al, 2006). However, joint incongruity as seen in Bernese Mountain Dogs, with constant overloading of the remaining weight bearing surface, (i.e., the contact area of the humero-ulnar joint), can hold responsible for the fragmentation of the apex of the medial coronoid process. Bernese Mountain dogs with a FCP without INC can be

seen only in 20% of the Bernese with ED. Based on the findings of Gemmill et al (2005), it can be assumed that the radius is too short rather than the ulna too long, although it can not be excluded that the ulnar notch is underdeveloped (i.e., too small) in relation to the humerus. The cause for FCP in Labradors, Golden Retrievers and Rottweilers, characterized by a fragmentation of the coronoid process at the radio-ulnar joint is still unknown, however the anatomical study of Wolschrijn & Weijs (2004) in coronoid processes of Golden Retrievers pups may give an indication. An anisotropic structure of the trabeculae with an orientation in the direction of the proximodistal axis of the ulna is already present at 6 weeks after birth. This primary alignment is perpendicular to the humeroulnar articular surface, matching the direction of the compressive forces applied to the medial coronoid process by the humeral condyle. The secondary alignment appears at 13 weeks after birth and is directed along the cranio-caudal axis of the medial coronoid process, toward the attachment of the annular ligament. Excessive pulling force of this ligament might be responsible for the fragmentation of the coronoid process in Retrievers. Vulnerability of the growing bone at the site of the coronoid process along the split lines is also supported by the work of Künzel and co-workers (2004).
Danielson et al (2006) describe the presence of direct and indirect indications of microdamage in subchondral (trabecular) bone in the medial coronoid area of elbows of dogs with FCP, which coincided with loss of osteocytes and their lacunocanalicular network and thus their nutrition and intercellular communication. The FCP self revealed porosity whereas the surroundings reveal osteosclerosis. Wind (1982) Ubbink et al (1999), Collins et al (2001) and Gemmil et al (2005) are supportive of the findings of Danielson et al (2006) in that they all report on the strong association between joint incongruity and FCP. A decreased radius of the ulnar notch is hold responsible for FCP by Wind (1982) although this is questioned by others (Preston et al, 2000; Maierl et al, 2000)
In any case, it is very unlikely that normal weight bearing even during playing is responsible for the FCP frequently seen in particular breeds. The osteosclerosis can although express an abnormal micro-architecture of the joint caused by shearing forces with fragmentation of bone fragments as a result.

Conclusion

In summary, elbow dysplasias (including UAP, FCP, OCD and INC) could spread among certain dog breeds, due to the (over)use of a limited number of breeding dogs affected with a disease allele which did not come to expression in all cases. Based on the heritability estimates as published in veterinary literature, environment may play a role in cases the genotype comes to expression. Since dietary intake of calcium and vitamin D may cause disturbances in endochondral ossification and thus may play a role in the occurrence of UAP, FCP, OCD and INC, unbalanced diets or excessive food (and thereby mineral) intake should be avoided. Although trauma may play a role in the occurrence of FCP along the split lines in possibly young skeleton with delayed modelling, the preventive or causative influence of physical activity or over-use on elbow joint development in dogs is still largely unknown. When the animal is not genetic at-risk, these environmental factors (like diet and micro-trauma) will not play a significant role in the occurrence of ED.

Screening of elbow joints to decrease the incidence of ED in the breeding stock and its offspring, is advocated by many researchers, kennel clubs, as well as by the FCI, OFA, IEWG and other umbrella organisations (Swenson et al, 1997, Kirberger et al, 1998). The quality of the radiological investigation (radiographs and scrutineers) as well as breed, age and sex of the animal will influence the success of a breeding programme for ED (Mäki et al, 2000). Only supranational and open registration of well defined diseases entities and breeding measures based upon the findings of this screening will decrease the incidence of elbow dysplasias. In the future DNA-screening techniques may lower the incidence of ED even further.

Standardisation for ED screening within a country, in Europe or preferably within a breed world-wide, will facilitate comparisons of screening-certificates and the quality of the breeding stock. (See for a concept ED-form the last page of these proceedings).
An evaluation of genetic counselling service in one dog breed revealed that breeders tended to rank exterior phenotypic characteristics first and reports from the counselling service on four frequent occurring diseases second. This indicates the need for better communication to the breeders world to inform about the function and advantages of selected breeding and the responsibility of breeders and their associations to improve the quality of life of the dogs they breed (Traas et al, 2006)

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Etiopathology of the joint incongruency of the elbow in the dog.

Dr. Gabriel I Ramirez.

Joint incongruence of the elbow has been a problem that researchers of this theme have been working on it in recent years. It is called joint inconsistency when no isometric between joint surfaces exists. However, in complex and complicated joints where more than two bones are involved, this definition can cause confusion. The elbow joints consists of a humeral condyle, with the distal point of the trochlear notch perfectly fitting between the condyles; the more distal portion of this trochlear notch stabilizes the joint with the anconeal process. A slight **asymmetry between** medial coronoides process, point trochlear notch and anconeal process, will lead to differences in pressures between the joint surfaces, which may cause articular damage, a deficiency in nutrition of the cartilage by lack of contact, and surface fibrillation. In others points where pressure is greater, chondromalasia and eburnaction of the joint surface may occur. Therefore, must exist a perfect pressure harmony on any joint elbow surface. A **minimal gradient of pressure** may alter the joint physiology and thus initiate the osteoarthritis process and guide to the bone to an irreversible and chronic degeneration (osteoartrosis). Other factors to consider are the **growth lines or physis:** (1) condyle and its growth physical lines (3 at least), (2) the radial head with a proximal and distal growth plates, (3) the ulna with two proximal growth plates and one distal .

The physes or growth plates have an important role, since when there is an **asynchronic** growth, this will cause articular inflammation (synovitis, synovial fluid changes, cartilage fibrilation, chondral edema, chondromalasia, eburnation of joint surface, osteophytes formation and loss of architecture and function of the joint surface. When this occurs, the patient will present claudicatio, increased intra articular pressure, pain to extension of the joint, crepitus, ongoing pain, and eventually reluctance to walk, muscle atrophy and loss of function of the joint. This growth asynchrony is more visible in large breed dogs during the rapid growth phase which are more prone to injuries that cause physical damages. This includes Salter Harris type V and VI fractures (i.e., micro fracture and subperisoteal hemorrage), and early closure of growth plates of the radius or ulna. The distal physis of the ulna is the most commonly damaged. Something that must be considered in the **asynchronic** development of radius, ulna and humerus is the nutrition of these large breeds patients, with an excess of trace elements and energy. This makes these dogs more sensitive to get diseases in the elbow, among many other bone development problems.

It is very easy to suffer from an abnormality of the elbow. When all these factors are analyzed, it is possible to talk about **Joint Incongruency** (Figure 1) when (1) the radial head is higher than the surface of the ulna, (2) the coronoid processes are higher than the radial head, and (3) the troclear notch presents a roundabout, and ovale and not a circle around the condyle.

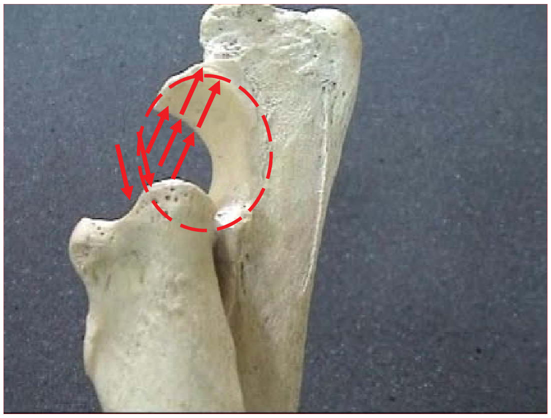


Figure 1.

When the radial head is at a higher level than the coronoid area, this will cause an increased pressure in the trochlear notch. In the trochlear notch this may cause chondromalacia and eburnation of the joint surface, as well as on the joint surface in the medial condyle. Although not verified so-far, it could also be a cause of osteochondrosis dissecans in the medial portion of the humeral condyle.

video 1 shows excision of the medial coronoid, chondroplasty, and joint surface cleaning-up process, and **video 2 shows** Chondroplasty with vaporiser and arthroscopical spoonand excision of the coronoid process is shown. It is noted that inconsistency is caused by an elongation of the radius.

The joint incongruity between ulna (medial coronoid process) and the radial head may cause a repetitive continuous trauma of the radial head on the medial coronoid process. Till a certain age, the medial coronoid process that is maturing, can fail if it is stressed due to inflammation by chronic trauma. (Fig. 2) This can go from an osteochondrosis in the area of the medial coronoid to changes in trabecular bone structure causing micro fractures and collapse of the subchondral bone.

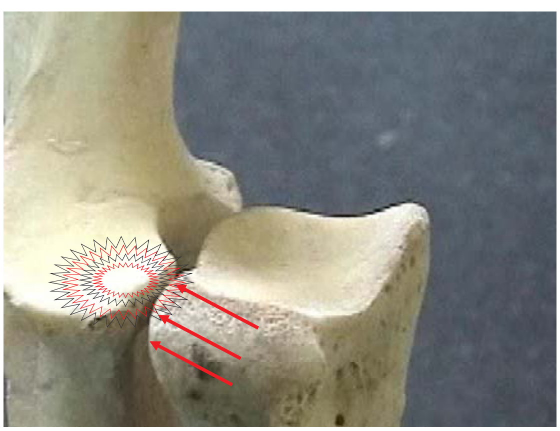


Fig. 2.

When the damage occurs by direct trauma in a patient with a mature coronoid, then the total and complete fracture occurs from the coronoid process. In large breed dogs, this has happened when 4 mm from the tip of the coronoid towards the trochlear notch has been fractured.

Video 3 . Incongruence of the elbow (point curvature with humeral condyle and the radius with the ulna): note the chondromalacia and eburnation of the joint surface. Chondroplastia is performed by withdrawal of the medial coronoid process and of affected cartilage (Fig3)

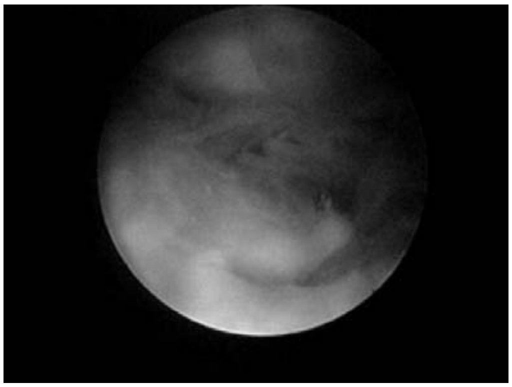


Figure 3.

At the beginning of incongruity of the elbow, when the patient is 5 - 7 months of age, this may coincide with lameness of the front limb with elbow pain. When radiographs are taken, there are not always radiographic changes indicating a possible diagnosis of the fragmentation the coronoid process. On CT there is not always the line fragmentation; on bone scintigraphy ther will be a hot spot in the area of the medial coronoid process. When CT scan is performed, there may be also synovitis, cartilaginous edema and osteochondrosis in the coronoid process. When arthorscopy is performed, the coronoid process and subchondral bone may be intact without any fracture; this is the first stage before the subchondral bone will be fragmented. At this stage arthroscopy is of great help to get an accurate diagnosis, and more accurate in certain cases than with the three above-mentioned (X-ray, CT or scintigraphy) diagnostic techniques.

When a German Shepherd, Labrador retriever, Rotweiller, or Golden retriever between 5 and 7 months of age with claudication in anterior limb are offered in the clinic for consultation, first common development diseases such as panosteitis have to be discarded. An ununited anconeal process or shoulder OCD, and anterior limb trauma should be excluded. Then think about a **fragmentation-osteochondrosis of the medial coronoid process**; but one should keep in mind that CT-investigation can have false negative results, that bone scintigraphy could confirm the diagnosis and that arthroscopy can remove any doubt. This is a great advantage of the arthroscopy being both a diagnostic and a therapeutic technique,and it is very accurate and goes together with minimal invasion.

When the coronoid process exceeds the radial head, it will be easy to obtain a classic case of fragmentation of the coronoid process (Fig. 4) which can be observed in a radiographic study. For some authors, the craniocaudal view either with thirty-fifth degrees internal rotation, or with the X- ray beam to 35 ° with respect to the horizontal plane is useful. However, in my opinion, it is not useful in all cases only in them in which the process is very obvious. In many patients, the mediolateral view of the elbow may reveal sclerosis of the subchondral coronoid bone, elongation of the coronoid and in advanced cases osteoarthrosis in the cranial portion of the radial head as well as in the insertion of the medial collateral ligament at its humeral attachment. There may also be osteoarthritic changes in the proximal and dorsal portion of the anconeal process.

Today Noel Fitzpatrick has come to think the insertion of the brachial biceps in the craniomedial side of the radial head.,suffers from certain contracture which causes pain in the joint due to increased pressure in the elbow joint. It should be studied further, how that contracture causes increased pressure on the joint surface of the medial coronoides process. Something that is clear, is that the innervation that exists in the medial condyle by the radial nerve, runs along to the ulnar nerve which goes up the intermuscular septum entering and ending at the periosteum in the medial aspect of the humeral condyle (Figure 4) .

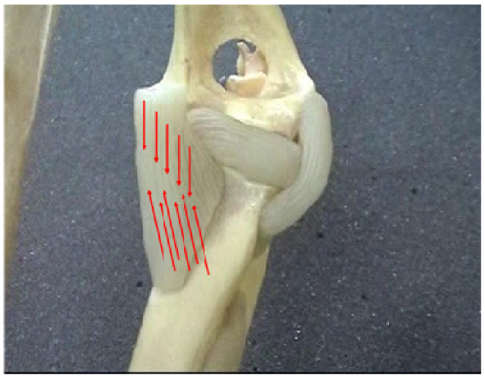


Figure 4.

This muscle contraction or the tendon of the brachial biceps in their insertion in the craniomedial portion of the head of the radius could cause a primary pain. Later this contracture may cause increased pressure on the articular surface causing chondromalacia in the medial coronoid area and at the surface of the trochlear notch of the medial humeral condyle as indicated in Figure 5.

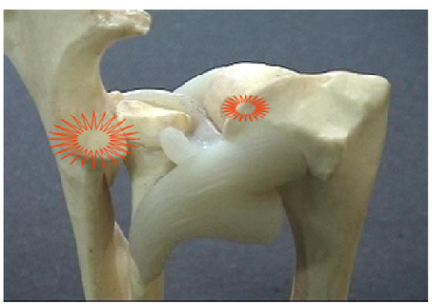
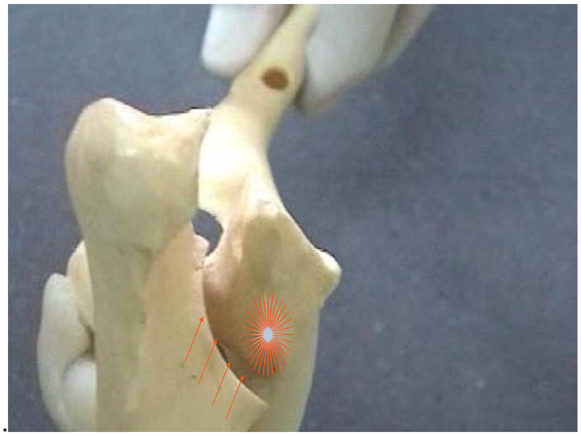


Figure 5.

However, in some patients there are findings that not only affects the joint surface by contact and stress, but that the injury extends in the trochear notch, the coronoid process and the medial aspect of the humeral condyle (Fig. 6).
In cases like this, there may exist in addition incongruency by **asynchronic** growth rate of the radius and ulna (see Figure 7), there can be an **oval trochlear notch** (See Figure 8) that causes increased contact pressure in humeral condyle, medial coronoid process, radial head and anconeal process.

.  Figure 6.

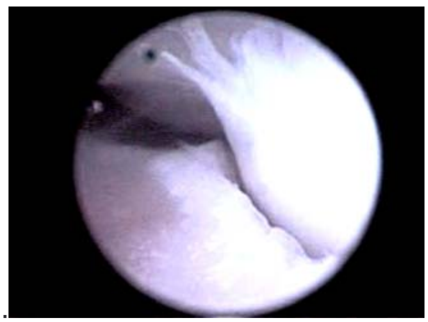
.  Figure7

 Figure 8

It is the opinion of the author, that all that dead cartilaginous tissue detached from subcondral bone (in case of osteochondrosis) for lack of nutrition or excessive pressure abnormally, causes that the joint surface will be released and form **joint garbage.** This is a "dusty" material that is suspended in the synovial fluid and that finally goes to the bottom of the joint. This material shall be deposited in the collateral ligaments, but the vast majority of these remains of dead cartilage is deposited in the space formed between the radius and the ulna. I think that the joint garbage may degenerate on the long term and will in some cases cause the osteophytes. In patients who, after arthroscopy and the chondroplasty, this joint garbage was not removed, will keep the inflammatory process. Months later, when a second arthoscopy will be performed, small pieces of calcified cartilage, are found as true osteophytes.

A general consensus of researchers of the elbow joint is that the treatment to prevent the elbow osteoarthrosis must be **early** , i.e., during the first months of life until there are degenerative changes, to stop the elbow arthritis in the dog. So, if a young patient is introduced with articular incongruency , the most appropriate therapy is to perform ulnar osteotomy or radial elongation. It is important before arthroscopy and treatment with condroplasty and total coronoidectomy, leveling of the pressure on the portion medial joint is considered. Until now there are two techniques known, including an osteotomy sliding humeral (Kurt Schulz, Noel Fitzpatrick) and the rotating osteotomy humeral (Slobodan Tepic) technique. When some of these osteotomies are not performed, then the patient to be treated with any the inevitable above-mentioned forms will be suffering from osteoartrosis in the future.

Non-surgical treatment of inconsistency of the elbow includes in my clinic of:

1. Hyaluronic Intra articular or intravenous 1 ml to less than 20 kgs of weight and 2 ml patients over 19 kgs of weight patients days 1, 7 and 14.

2. Glycosamino Glycanes , intra muscle the implementation of 4 mg / kg eight days 1, 4, 7, 11, 14, 18, 21 and 24 applications.

3. Administration of antioxidants as Omega-3 fatty acids.

4. Non-steroidal anti-inflammatory administration at least for 60 days, after arthrotomy or arthroscopy.

5. Control weight, rehabilitation and physiotherapy.

6. Feeding with diets to help the good function of joints.

Remember that osteoarthritis is a syndrome helps to know that the use of these drugs is necessary in the recommended periods and dosages to achieve the desired synergy. In little more than 10 years using this treatment, I have experienced satisfactory improvements of the quality of life of more than 1500 patients.

In summary: The inconsistency articulate the elbow consists of (1) the radial head is higher than the surface of the ulna, (2) the coronoid processes are higher than the radial head, (3) the point curvature presents an oval and not a circle around the condyle. This is caused by (1) pathologies of the **growth lines** (retained cartilaginous core, premature closure growth line), (2) consumption in excess of **trace elements** during development, (3) accelerated growth in large and giant breed dogs. Early diagnose can be made by (1() physical examination in visits to vaccines, (2) radiological examination at the first sign, (3) arthroscopic valuation. Treatment includes: (1) arthroscopical cleaning, (2) chondroplasia, (3) corrective osteotomies (anconeal, coronoid, UNLAR, radial, humeral depends on the case). Conservative and after-surgery treatment, a comprehensive anti arthritis treatment should be considered, with a follow-up evaluation every 18 months.

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The clinical relevance of elbow denervation in pain management

Dr. Helia Zamprogno, DVM, MSc, PhD

Dogs are frequently affected by degenerative joint disease (DJD) and studies have reported that the elbow joint DJD has an incidence rate of 12.8% to 17.8% [1,2]. In all of the studies, degenerative joint disease (DJD) is the most common painful condition of joints.

There are several available treatments designed to restore function and/or manage the pain associated with DJD, however, when the affected joint is the elbow, the options are limited to pain management based on non-steroidal anti-inflammatory drugs (NSAIDs) administration, arthrodesis or total elbow replacement (TER). The first option is associated with gastrointestinal, renal and hepatic side effects while the second results in poor functional outcome and the later, has not yet been fully integrated to the clinical setting [3-5].

Joint denervation is a surgical technique based on the selective neurotomy of the sensory nerve fibers within the peri-capsular region, resulting in permanent or long term pain relief [6,7]. Denervation of the elbow and other joints, as well as their good outcome results have been described in humans [8-10]. In small animal veterinary medicine, the hip is the only joint where denervation has been described [11-13]. Although all the subjective studies demonstrated more than 90% of success rate after the surgical procedure [11-13], objective analysis showed that only 50% of the patients had improved [14].
Through an extensive anatomical study and characterization of the innervation and anatomical relationships of the median, musculocutaneous, ulnar and radial nerves to surrounding structures of the forelimb, a surgical technique to promote the denervation of the elbow was designed. The live study demonstrated that only the nerves branches to the joint capsule were resected.

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Screening programme for Elbow Dysplasia

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Introduction

From a variety of scientific studies the hereditary aspects of elbow dysplasias (i.e., fragmented coronoid process [FCP], osteochondritis dissecans [ocd], ununited anconeal process [uap], and elbow incongruity [inc]) has been demonstrated. Although the pathophysiology of the different entities (why the coronoid breaks off, how inc occurs) has not been elucidated, and the mode of heritance is not known for most of the entities of ED, it has been shown in different breeding programmes that exclusion of the positives helps to decrease the incidence of ED in well described populations.
Veterinarians know the limitations of visualisation the genotype by radiographs, but realize that it is so far a technique which is available, affordable, and acceptable for most dog owners. Although it is less reliable than the more invasive arthroscopy or the more expensive CT-scanning, screening large numbers of dogs have been proven to help breeders to lower the incidence of ED in the populations. DNA-screening techniques are not available yet.

How many radiological views are in use?

From studies published by different radiologists it can be learned that more views of the elbow joint reduces the amount of false negative diagnoses, reason why radiological investigation of patients with elbow lameness is performed by making two or more radiological views.
In order to discriminate between good and bad elbows at a screening programme both

1. the primary entity of ED (FCP, OCD, UAP, INC) and
2. the degree of arthrosis (absence or presence in different degrees) are looked for according to the protocol of the IEWG.

It is of help to realize that there may be more reasons to develop OA than ED alone (*false positives*), Contrarily, with increasing frequency old dogs (>3 years of age) are seen with elbow lameness, total free from OA in the elbow joint (*false negatives*), but positive on bone scanning and/or CT-scanning for FCP which restore after surgical removal of the FCP.
In some screening programmes it was decided to limit the amount of view to one, i.e., mediolateral view with a flexed elbow joint. This is the view with the greatest chance to visualize osteophytes when screening takes place at old age (allowing osteophytes to develop). This view might be sufficient when screening is performed in a large part of the population of the breed (to compensate for the significant amount of false negatives) especially of breeding stock ánd offspring (to draw conclusions from the occurrence of positive offspring from seemingly negative parent animals). This is for example the case in Sweden. In Sweden the incidence of ED in Rottweilers decreased from 85% in 1979 to 25% in 2004 and in Bernese Mountain dogs from 52% in 1985 to 18% in 2004, by this mass screening system extended to input from reports from veterinarians and assurance companies on arthroscopy or arthrotomy findings in these breeds (Dr. Audell, personal communications München 2005). In Sweden >80% of the breeds are screened !

In other countries where there is a less mass screening, more precisely radiographs should be judged, in order not to overlook ED in the screened dogs.The German group (i.e., Germany, Austria, Switzerland) and also France grade both the primary lesion (including FCP, OCD, UAP, and INC) as to the grade of OA, so they look at a minimum of 2 (ML and AP), but preferably more (including APMO) views (see Table).

The screening of elbow joint for elbow dysplasias is voluntary in many other countries, and is organised by the national Kennel club, a breeder club or just on an individual basis by a certain owner or breeder. When organised by a breeders organisation, this organisation can provide an official registration form to veterinarians on their request, can organise independent screening by a skilled screening panel, can mail the (digitalized) radiographs to the panel and can register and distribute the results to owner and breeder clubs.

Different screening systems in Europe with scoring according to IEWG standard

Country	**1 view (ML flexed)**	**2 views (ML and AP[MO]**	**3-4 views**	**OA score**	**Primary lesion score**	**Amount of dogs**
Sweden	+			+		11,000 per year
Norway	+					4,000 per year
Germany Austria France			Mlflexed, ML neutral, AP	+	+	25-40% of breed
Germany			ML flexed			German Shepherd dog
Italy			+			2 screening panel systems; 1200 per year
UK	+					1230 per year
Netherlands			MLflexed& neutral, APMO, AP	+	+	800-1000 per year
Servia		ML&AP		+	+	
Slovakia		ML&AP		+	+	

What is the minimal age for screening?

For the breeds at high risk for ED (i.e., Labradors, Golden Retrievers, Rottweilers, German Shepherd dogs, Bernese Mountain Dogs, New Foundlanders and other breeds) >2 views radiological views are advisable, i.e. mediolateral (ml) extended and flexed, anterior-posterior and anterioposterior-oblique (apmo).
The minimal age for dogs is 12 months (In the USA 24 months) whereas for large breed dogs it can be synchronous with HD-screening (i.e., 18 months in many FCI-contries). For other breeds which are not at risk for ED according to national or international reports, only two views can be required, i.e., ml-extended and apmo. On request of breeder clubs a special screening program can be installed.

Who is entitled to read films for screening?

The film reading is performed in many countries by one to three veterinarians, either together or in sequence, and are preferable registered specialists in radiology or orthopaedic surgery. This panel should check the quality of the film regarding exposure, positioning, and completeness of the set. Screening for ED includes screening for the primary pathology (fragmented coronoid process, osteochondritis dissecans, ununited anconeal process, incongruity, and other entities including the avulsion of the medial humeral condyle), and/or for the grade of osteoarthrosis (OA) according to the guidelines as given by the IEWG in this proceedings and on its web page: http://www.iewg-vet.org/archive/2004/Prcdgs2004_2.pdf, (contribution of Dr Flückiger). The possibility for appeal should be offered.

Does the screening panel give breeding advises?

It is the responsibility of the individual breeder clubs to implement the results of screening into their breeding program. Consequences drawn from it are democratically decided for by the members of the breeder clubs and the outcome depends on many factors, including the incidence of ED within the breed.
Too many breeder clubs do not take their responsibility yet in respect to screening for ED, despite the fact that it is frequently diagnosed in their breed. Future awareness of potential buyers, the guarantee sellers have to give by law for their product (including dogs), and the governmental attention for breeding healthy animals will persuade breeder clubs to make use of the infrastructure which is present in many countries these days.

Is radiological screening for ED the most sensitive method?

Until DNA-screening techniques for screening different entities of ED in different breeds are developed, breeders can make use of sophisticated and non-invasive imaging techniques, although it may include a certain percentage of false negatives. The most practical technique until now is making and screening several radiological views together with open registration of results, offspring control, and consequent implementation of the results in breeding programs. In orthopaedic practices more sophisticated techniques including bone scintigraphy and CT-scanning, or more invasive techniques as arthroscopy or arthrotomy are performed. These methods are not in use in screening programmes. Till DNA-screening techniques are developed, the veterinary profession has to uniform the screening methods to solve the paradox that the better the screening, the more likely to be positive, and thus the greater the chance to be excluded from breeding and the harder to sell the dog or its offspring. Certification should at least make the way and quality of screening transparent and IEWG likes to assist the veterinary profession in this. Veterinarians associated with the WSAVA are in the strong position to implement the certificate (see copy) as has been designed for dog owners when dogs are sold within or outside the country, to offer insight to the potential buyer if the animal has been tested and if so, according which protocol.

IEWG or WSAVA

Certificate of radiological Elbow Dysplasia examination

Examination based on International Elbow Working Group Standards

Logo Kennel Club

Archieve and Registration for Great Britain

Etc..Etc..

Registration .nr. Examination

ED-GB

National reg.veterinarian reg.nr. examiner

Animal

Name

Breed

Registration nr — Tattoo

Microchip nr

Date of birth (day - month - year) — Sex: ☐ F (female intact) ☐ M (male intact) ☐ Fs (female spayed) ☐ Mc (male castrated)

Owner/agent

Name

Address

Country, Zip (country — ZIP code) — Town

The undersigned agrees to the WSAVA/IEWG examination protocol, the rules of the national scheme and confirms that the dog submitted for examination is the one described above. Signature also means that the results are available for official publication.

Signature owner / agent

Examination (veterinarian, age o/t dog, radiologic views)

Veterinarian

Name

Address

Country, Zip (country — ZIP code) — Town

Identification o/t dog

Check tattoo: ☐ Correct ☐ Partly /unreadable ☐ Incorrect ☐ Absent

Check microchip: ☐ Correct ☐ Incorrect ☐ Absent

Radiologic examination

Date radiologic examination (day - month - year) — Age (Year, Months)

Number of radiographs per elbow: 1 2 3 4 5

Radiologic projections:
- ☐ ML-flexed (Medio-Lateral 45°-flexed)
- ☐ ML-neutral (Medio-Lateral 90°-ext.)
- ☐ CC (Cranio-caudaal)
- ☐ ML-extended (Medio-Lateral >120°ext.)
- ☐ CC-15° pronated (Cranio-caudaal-15° pronated)
- ☐ Other: (specify)

The undersigned agrees that the examination is performend according to protocols of the WSAVA (World Small Animal Veterinary Association) and her affiliate, IEWG (International Elbow Working Group).

Furthermore the undersigned states that the dog, submitted for IEWG-elbow-examination is the above mentioned dog. The results will be registered and archieved by the National Kennel Club

Signature veterinarian

Results evaluation by National ED-panel

Veterinarian

Name

Address

Country, Zip (country — ZIP code) — Town

Radiographic evaluation

Date panel evaluation (day - month - year)

	Left elbow: UAP	FCP	OC	INC	Other		Right elbow: UAP	FCP	OC	INC	Other
Primary lesion	☐	☐	☐	☐	☐	← Affected →	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	← Suspected →	☐	☐	☐	☐	☐
	☐					← (No definite proof of a primary leasion) Free →	☐				
	☐					← (No sign of secondary arthrosis) Grade 0 →	☐				
Secondary arthrosis	☐					Borderline	☐				
	☐					Grade I	☐				
	☐					Grade II	☐				
	☐					Grade III	☐				

The undersigned agrees that the **radiographic evaluation** is performend according to protocols of the WSAVA (World Small Animal Veterinary Association) and her affiliate, IEWG (International Elbow Working Group).

Signature authorized examiner

Interpretation

Interpretation based on the current recommendations of the International Elbow Working Group (IEWG), an affiliate of the Wold Small Animal Veterinary Association (WSAVA)

Primary Lesions
- UAP Ununited Anconeal Process
- FCP Freagmented Coronoid Process
- OC Osteochondrosis or Osteochondritis dissecans of the medial humeral condyle
- INC Incongruency of more than 2mm between articular surface of Radius and Ulna
- Other Lesions Avulsion medial humeral epicondyle; Mineralisation medial collateral ligament/origin flexor muscles; Other: .

ED grade, based on the secondary arthrosis
- **Grade 0** No signs of arthrosis
- **BL** Border Line: Undetermined changes
- **Grade 1** Osteophyte formation of less than 2 mm anywhere in the elbow joint
- **Grade 2** Osteophyte formation of 2-5 mm anywhere in the elbow joint
- **Grade 3** Osteophyte formation of more than 5 mm anywhere in the elbow joint

Note: The classification Grade 0 (or no detected primary lesion) does not imply that the animal is genetically sound. Based on the current scientific knowledge IEWG does not recomment breeding of arthrotic animals or animals displaying a primary leasion!.

Space for sponsors !!!

International Elbow Working Group

The International Elbow Working Group [IEWG] was founded in 1989 by a small group of canine elbow experts from the USA and Europe to provide for dissemination of elbow information and to develop a protocol for screening that would be acceptable to the international scientific community and breeders.
The annual meeting is organized for the purpose of exchanging information and reviewing the Protocol. All interested persons are invited to attend the meeting and to participate in its activities.
The IEWG is an affiliate of the WSAVA.

IEWG meetings were held in

1989 Davis
1990 San Francisco
1991 Vienna
1992 Rome
1993 Berlin
1994 Philadelphia
1995 Konstanz
1996 eruzalem [cancelled]
1997 Birmingham
1998 Bologna
1999 Orlando
2000 Amsterdam
2001 Vancouver
2002 Granada
2003 Estoril
Bangkok
2004 Rhodes
2005 Amsterdam
Mexico
Munich
2006 Prague
2007 Munich
2008 Dublin
2009 Sao Paulo

IEWG 2009

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secretary	Thijs How	How@wxs.nl

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