PROCEEDINGS

16th annual meeting of the

INTERNATIONAL ELBOW WORKING GROUP

Saturday October 9th, 2004
Rhodes, Greece

WELCOME ADDRESS

Welcome at the 16th meeting of the International Elbow Working Group

Dear Colleagues,

It is a great pleasure for the organizing committee of the congress of the International Elbow Working Group (IEWG) that the congress committee of the WSAVA-FECAVA Rhodes congress offered hospitality to the 16th IEWG meeting. The WSAVA-FECAVA Rhodes committee not only offered the IEWG to be held during the congress but also as part of the main programme. This offers more veterinarians, interested in the work of the IEWG the possibility to participate in this meeting, and to learn more about the practical approach of patients suspected of elbow dysplasia (ED), of the practical aspects of screening for ED and the hereditary background of ED and its importance to install and cooperate in national and international screening programmes. In addition the surgical treatment of ED and non-hereditary diseases involved with elbow function will be discussed. Free communications and the possibility to discuss your cases and/or radiographs of dogs suspected of ED will complete the IEWG-2004 programme.
The IEWG, as an affiliate of the WSAVA, aims to inform veterinarians all over the world about the aspects related to ED in order to uniform investigation techniques, the grading of the different entities playing a role in ED and of the resulting osteoarthrosis, and to inform about the newest developments in elbow research. Although a selection has to be made on the latter, the IEWG-2004 programme accomplishes these aims with this varied programme.
The IEWG is grateful to the sponsors of IEWG, Iams Europe and Pfizer International, that they made it again possible to invite knowledgeable and interesting speakers to present an informative series of lectures to the participants of this prestigious World Congress.
Information of the membership of the IEWG, of the grading system for ED screening, the proceedings of the last 6 meetings of the IEWG and much more is all easily accessible for the interested veterinarian by the enthusiastic work of Dr Packard, at the IEWG web side:
www.vetmed.ucdavis.edu/iewg/iewg.htm
On behalf of the organizers I thank you for your interest in the IEWG and wish you a fruitful meeting.

Herman A.W. Hazewinkel,
President IEWG

The International Elbow Working Group acknowledges the financial support by

The Iams Company

and

Pfizer Animal Health

PROGRAMME IEWG 2004 RHODES MEETING

8.30 – 8.35	Opening and welcome by the chairman of the IEWG	Hazewinkel, H.
8.35 – 9.15	Anatomy of the elbow joint and nomenclature of Elbow Dysplasia	Flückiger, M.
9.15 – 10.00	How to make good radiographs for Elbow Dysplasia screening in practice	Flückiger, M.
10.00 – 10.45	Coffee break	
10.45 – 11.30	Clinical investigation and treatment of Elbow Dysplasia	Vezzoni, A.
11.30 – 12.15	Clinical investigation and treatment of traumatic elbow diseases	Denny, H.
12.15 – 14.00	Lunch Break	
14.00 – 14.45	Hereditary aspects of Elbow Dysplasia and the ED protocol	Hazewinkel, H
14.45 – 15.30	Free communications Breeding for improved hip and elbow status in Swedish dogs Malm, S. Growth and development of the medial coronoid process of retrievers Wolschrijn, C.F. Discussion X-ray interpretation of your own X-rays	
15.30 – 15.45	Coffee break	
15.45 – 16.45	Business meeting [open to all members of the IEWG]	

List of speakers

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How to take good radiographs for Elbow Dysplasia screening in your practice

(Requirements for the internationally standardized screening procedure)

Anatomy of the Elbow Joint and Terminology of Elbow Dysplasia

Mark Flückiger, Prof. Dr.med.vet., Dip. ECVDI, University of Zurich, Switzerland

Radiographic technique

1. Minimal age for routine screening is 12 months
   Check specific breed-club requirements!
   Dogs with signs of elbow lameness should be radiographed at any age
2. Both elbows are radiographed
3. Rare Earth screens with a speed of 200 or less are recommended
4. No grid is used for the examination, the elbow is placed directly on the cassette
5. The beam is collimated, which improves image quality
6. The mediolateral projection is taken with the elbow in flexed position (45° opening angle) resulting in concentric superimposition of the medial and lateral humeral condyles. The MCP is best identified on a mediolateral 15° oblique view, achieved when the limb is placed in lateral position, extended and 15° supinated. Good results are achieved with a 60 kV-setting and low mAs (depending on system).
7. Additional views such as
   - mediolateral view in neutral position (approx. 110° opening angle) and
   - craniocaudal view with 15° limb pronation and 15° beam angulation in proximal direction

   are strongly recommended
8. Radiographs are permanently marked including the date of the examination, the identity of the dog, the identity of the owner of the dog and the clinic making the study

Film interpretation procedure

9. Radiographs for elbow disease are screened by qualified persons. An open list of qualified persons has been filed at the FCI office by the advisory panel of the scientific committee of the FCI
10. If the elbows cannot be graded, a second examination is indicated after 3 months
11. A possibility for appeal prior to release of the results is provided
12. Results of the evaluation are open to researchers, dog owners and breeders
13. Radiographs will be archived at an appropriate location for 10 years

Film Interpretation

Radiographic findings vary depending on etiology, breed, severity, and duration of ED. The radiographic diagnosis of ED is based on presence of arthrosis and/or a primary lesion such as

malformed or fragmented medial coronoid process (FCP)

ununited anconeal process (UAP)

osteochondrosis of the medial humeral condyle (OCD)

marked incongruity of the articular surface (step formation, subluxation) (INC)

Futher findings (of unknown etiology and relevance) may be

mineralisation of periarticular tissue (flexor tendon or bursa of medial epicondyle)

DJD resulting from unknown origin

any other abnormality noted

Radiographic findings indicative of FCP (Fragmented Medial Coronoid Process)

Mediolateral radiograph

- Increased subchondral bony density in distal part of semilunar notch, loss of trabecular pattern
- Step between radius and ulna
- Blurred cranial edge of medial coronoid process. The FCP-fragment is rarely seen!
- New bone formation
  - dorsally and laterally on the anconeal process,
  - on the cranial border of the radius
  - on the medial humeral condyle
  - on the lateral humeral epicondyle
- Uneven joint space width between humerus and radius.

Cranio-caudal radiograph:

- Bony irregularity and/or new bone formation on the medial border of humerus and ulna
- Visualisation of bony fragments is uncommon
- Step between radial and ulnar subchondral bone plate
- Humeroradial joint space medial wider than lateral, particularly in BMD
- Occasionally a subchondral bone defect in the medial humeral condyle with or without subchondral sclerosis (OCD or kissing lesion) is seen, but a bony flap is rare.

Beware of artifact: The sagittally running radiolucent line within the MCP on a slightly pronated projection usually represents the edge of the ulna but not a fissured PCM!

Findings with OC/OCD (Osteochondrosis, Osteochondritis dissecans)

DJD similar to FCP, but usually less pronounced. Typical findings are

- Defect in articular surface of medial humeral condyle, best seen either on the craniocaudal or mediolateral extended view
- A bony fragment is rarely visible
- Defect may be missed when suboptimal technique is used!!

Findings with UAP (Ununited Anconeal Process)

- Irregular radiolucent vertical line between anconeal process and ulna after 18 weeks of age
- Irregular subchondral sclerosis
- Progressive DJD depending on duration of process

Scoring

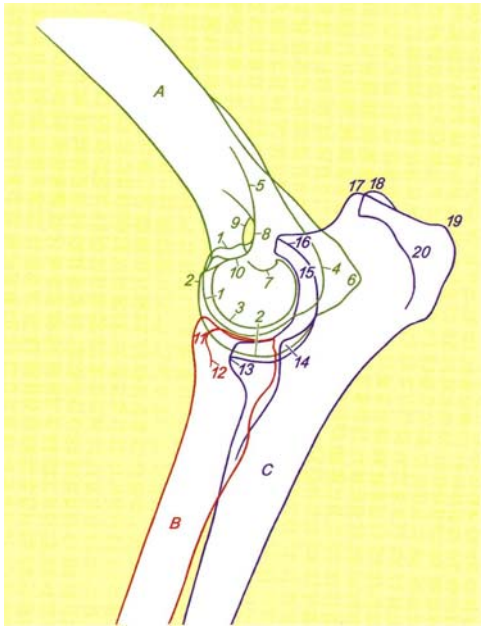
The elbow findings are scored according to severity of the arthrosis (DJD) and/or presence of a primary lesion using the IEWG (Int. Elbow Working Group) protocol

Elbow Dysplasia Scoring		**Radiographic Findings**
0	normal elbow joint	normal elbow joint, no evidence of incongruency, sclerosis or arthrosis
I	mild arthrosis	sclerosis of ulnar trochlear notch or, step =/< 2 mm between radius and ulna or, osteophyte formation less than 2 mm high
II	moderate arthrosis	osteophyte formation 2 to 5 mm high
III	severe arthrosis or “1° ED”	osteophyte formation more than 5 mm high or 1° ED such as UAP, FCP, OCD

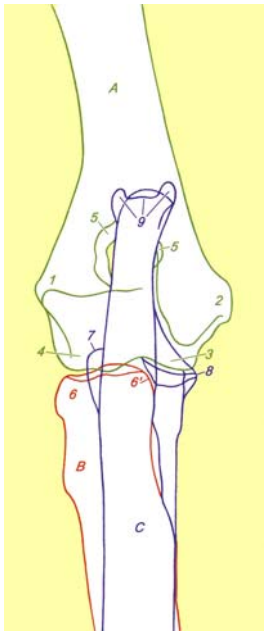
Normal Elbow Joint

(from Waibl et al.: Atlas of Radiographic Anatomy of the Dog, Parey 2003)

mediolateral view



craniocaudal view



Legend

A	Humerus
B	Radius
C	Ulna
2	medial humeral condyle
3	medial humeral conyle
4	lateral epicondyle
6	medial epicondyle
7	lateral coronoid process
8	medial coronoid process
13	medial coronoid process
14	lateral coronoid process
16	anconeal process

References

- http://www.ncbi.nlm.nih.gov/entrez/query.fcgi (Enter: Elbow dysplasia canine)
- Morgan JP, Wind A, Davidson A: Hereditary bone and joint diseases in the dog, schlütersche 2000.

Radiographic Projections for the Assessment of the Elbow Joint

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Discriminate Screening a Breed Population from Examination of a Lame Dog

Screening philosophy:

Cheap, easy, fast, sensitive, accurate, no chemical restraint, no stress to all

Consequently:

1 mediolateral view 45 ° flexed

Discriminate
Screening a Breed Population from Examination of a Lame Dog

Precise diagnosis in the lame dog:

Accurate, sensitive, practical

Consequently:

Minimal requirement are 2 orthogonal views.

Multiple views may be required for diagnosis.

Minimal Requirement for ED Screening

- A mediolateral view with the medial humeral epicondyle well penetrated, so that the dorsal edge of the anconeal process is clearly seen.

- The 45° flexed view allows for optimal identification of signs of arthrosis at the anconeal process, but results in axial rotation of the elbow, simulating joint incongruity.

Craniocaudal View

- An additional craniocaudal, 15° pronated projection is highly recommended as OCD lesions can rarely be seen on a mediolateral projection!
  (Lang et al. 1998, JSAP 39; 169)

- It allows to assess the congruity of the joint.

- A straight craniocaudal view is of no additional help.

MCP Views

- A mediolateral projection with 120° joint angle and 15° supination highlights the medial coronoid process and is helpful for assessing its integrity (Voorhout 1987, Vet Rad 28; 158)
- An distomedial-proximolateral 35° oblique projection has been reported to highlight the MCP (Haudiquet et al. AJVR 2002; 63: 1000)

Recommended Projections for ED Screening (IEWG)

mediolateral view
45° joint angle

craniocaudal view
15° pronated

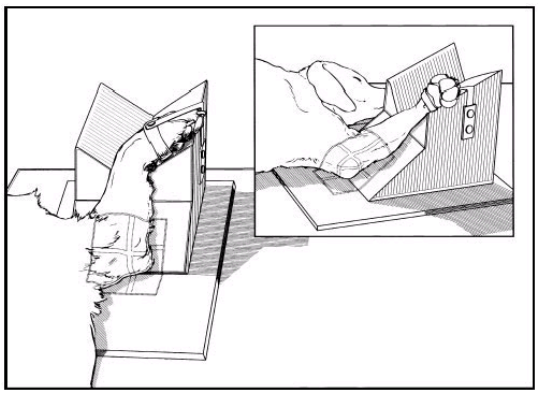
Additional Projections

mediolateral view
90° joint angle

mediolateral view
120° joint angle, 15° supinated

MCP-Projection

Technique:
- Custom made foam pad
- Lateral recumbency
- Limb elevated 35 °
- Joint angle 90°
- Supination 40°



Haudiquet et al. AJVR 2002; 63: 1000

MCP-Projection

- Projection: distomedial-proximolateral oblique 35° (Di35M-PrLO)

  Haudiquet et al.
  AJVR 2002; 63: 1000

Clinical investigation and treatment for elbow displasia

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Introduction

Elbow dysplasia (ED) is a well recognised developmental orthopaedic disease affecting growing dogs of several breeds. Common aspect of this condition is a progressive degenerative joint disease causing forelimb lameness. Asyncronous growth of radius and ulna has been described as one of the main causes of ED because of the resultant joint incongruity. ED is comprehensive of several diseases: fragmented medial coronoid process (FCP), ununited anconeal process (UAP) and osteochondritis dissecans (OCD).

Clinical signs

Forelimb lameness is usually seen the first time at the age of 4 to 6 months and quite often it is overlooked. With aging osteoarthritis develops and clinical signs became more consistent, particularly when the disease is affecting mainly or only one elbow. In bilateral disease the affected dog could not be clearly lame, but walks with short steps and tires easily. In chronic cases the range of motion of the elbow is limited both in flexion and in extension and the dog compensates increasing shoulder movements. Severe chronic ED can became invalidating and drug treatment can be required for all the life span.

Diagnosis

Elbow palpation and radiographic examination are usually enough to diagnose ED. The palpation shows a medial periarticular consistent swelling and when joint effusion is present lateral ectasia is noted. Reduction of maximal flexion is seen whith periarticular fibrosis and osteophyte formation. Radiographic examination shows different aspects in relation to the underlying disease and the age of the dog. The most common radiographic views are the medio-lateral flexed (45°) view, the medio-lateral extended (120°) view and the antero-posterior view with 15° of pronation. In FCP the early radiographic signs are ulnar subtrochlear slerosis and joint incongruity with increased radio-humeral joint space; with the progression of the disease ostephytes are seen on the proximal border of the anconeal process, on the radial head and on the medial humeral condyle; the medial coronoid process silouette is blunted or partially missing. In UAP the anconeal process is not fused with proximal ulna and different digrees of radio-ulnar incongruity due to longer radius pushing the humeral condyle proximaly can be seen. In OCD, the medial humeral condyle in the AP view shows a defect in its profile and a calcified cartilagineaous flap can be seen.

Conservative treatment

Most dogs with elbow dysplasia do not receive any treatment and the diagnosis is a casual finding during routine screening, because in many cases the disease is mild to moderate. The criteria for conservative or surgical treatment in dogs showing clinical signs is based on the age of the dog, on the severity of the disease and on the response to conservative treatment. Conservative treatment consists in the reduction of the body weight, in the control of physical activity (limiting it to walk on a leash and to swim) and in the administration of NSAD for 2-3 weeks. In chronic cases repeated cycles of NSAD may be required, while in acute relapses low dose corticosteroids (prednisolone 0,1-0,2 mg/kg) may be more effective.

Surgical treatment

The efficacy of the surgical treatment of elbow dysplasia is determined by the arrest or the limitation of OA progression and by the improvement of clinical signs. Because OA progression in elbow dysplasia is an early process, being already established at the age of 7-8 months, surgical treatment should be performed as soon as the diagnosis is achieved. The best results are seen when the surgical treatment is performed between 4 and 6 months of age, both for UAP and for FCP and OCD.

In UAP the early treatment is based in the improvement of elbow congruity with a proximal dynamic ulna osteotomy (DUO) and the screw fixation of the ununited anconeal process. The screw fixation in lag fashion of the anconeal process is performed always when it presents any mobility or in all cases to increase the possibility of its bony fusion. In 4 to 6 months old puppies the restoration of joint congruency and the fusion of the anconal process are likely to be achieved, while in older puppies the already established joint degeneration and the increased mobility of the anconeal process could prevent a complete healing.

In FCP the early treatment consists in distal dynamic ulna ostectomy to release the pressure on the medial and lateral coronoid processes. This procedure is performed by removing 4 to 5 millimeters of ulna, sub-periosteal, with a rongeur, approximately 2 to 4 centimeters proximally to the distal ulnar physis. The treated puppies are re-checked clinically and radiographically 3 to 4 weeks later to assess the improvement of joint congruency and of clinical signs. In case of persisting clinical signs and worsening of radiographic aspects with osteophytes formation, meaning that the coronoid process became fragmented, conventional joint inspection and FCP treatment are performed with arthroscopy or with mini-arthrotomy. In more advanced cases of FCP, with more radiographic signs of OA suggesting the fragmentation of the coronoid process, joint inspection and treatment with arthroscopy or with mini-arthrotomy is perfomed in conjunction with distal ulna ostectomy when the puppy is under 8 months of age, when the interosseous radio-ulnar ligament can be still stretched.

In OCD the early treatment consists in conventional OCD treatment with arthroscopy or with mini-arthrotomy, and in distal dynamic ulna ostectomy when joint incongruency is assed radiographically and intraoperatively.

Conclusion

The success of elbow dysplasia treatment is strongly influenced by the time of diagnosis and by the progression of the degenerative joint disease at that time. Cartilage destruction is a time based process and it is irreversible. Early diagnosis is the only way to intercept the disease and to surgically improve the joint environment and congruity. Early screening of puppies of predisposed breeds should be encouraged and accurate radiographic evaluation should be performed as soon as a puppy is showing foreleg lameness.

Clinical investigation and treatment of traumatic elbow conditions.

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Acquired traumatic conditions of the elbow include :

- Condylar fractures of the humerus
- Medial epicondylar fracture of the humerus
- Fractures of the proximal ulna and olecranon
- Fracture of the anconeal process
- Fracture of the radial head
- Luxation
- Ulnar fracture with radial head luxation (Monteggia fracture)
- Luxation of radial head in cats
- Avulsion and ruptures of the tendon of insertion of the triceps muscles

Diagnosis of traumatic elbow conditions is usually straight forward and is based on observation of the patient , gentle palpation of the elbow and radiographic examination. Diagnosis can usually be confirmed from orthoganol (mediolateral and craniocaudal) views of the elbows. Oblique craniocaudal views maybe necessary to confirm a condylar fissure in cases with incomplete ossification of the humeral condyle (IOHC) .

Condylar fractures of the humerus

Condylar fractures can be broadly classified as lateral , medial or intercondylar. The relative incidence of these categories , given below , is taken from reviews of 133 cases (Denny , 1983) and of 39 cases (Butterworth , 1992) , respectively. Condylar fractures usually result from a violent upward stress transmitted through the head of the radius onto the humeral trochlea. The lateral component of the humeral condyle appears to have the weakest attachment to the humeral shaft and fractures most frequently (56 and 57% of cases, respectively). In the face of even greater stress the medial part of the condyle is also sheared off giving rise to an intercondylar ('Y' or 'T') fracture (33 and 40 % of cases, respectively). Solitary fractures of the medial condyle occurred far less frequently (11 and 3 % of cases, respectively).

Spaniel breeds of dogs appear to be more prone to condylar fractures. Incomplete ossification of the humeral condyle (IOHC) , predisposing to fracture, has been demonstrated predominantly in spaniels (eg. American Cocker , Springer , Brittany Spaniel and Cavalier King Charles) , it has also been reported in the Labrador Retriever, Rottweiler and Pug . It has been suggested in the Cocker Spaniel that incomplete ossification of the humeral condyle may be a genetic disease with a recessive mode of inheritance(Marcellin-Little & others , 1994), In the UK the Springer Spaniel is the most commonly affected breed (Butterworth and Innes 2001).

IOHC is characterised by chronic intermittent lameness varying from mild to non weight bearing . There is pain on elbow extension.

A radiolucent line or fissure may be seen in the intercondylar region of the humerus on a craniocaudal radiograph of the elbow. Further radiographs with 15 degrees of craniomedial or craniolateral rotation increases the chances of seeing the fissure . CT is more sensitive for detecting IOHC. Arthroscopic examination can on occasions also demonstrate a fissure in the articular cartilage.

Placement of a transcondylar lag screw is recommended as a prophylactic measure in view of the high risk of condylar fractures in dogs with IOHC (Marcellin -Little et al 1994). Either a lag or position screw can be used. The largest screw possible should be used to minimise risk of implant failure - (4.5 mm cortical screw in average size Springer Spaniel).
Falls , jumping and sudden turns at exercise are the most common causes of lateral or medial condylar fractures. Intercondylar fractures are more likely to be caused in road traffic accidents. Lateral and medial condylar fractures affect predominantly immature dogs (peak age incidence at 4 months) whilst intercondylar fractures tend to be more evenly distributed between skeletally mature and immature dogs.
Radiographic diagnosis is straight forward however it is worth obtaining radiographs of the contralateral elbow in those breeds with a known predisposition to IOHC.
Condylar fractures are articular fractures and as such require surgical treatment with accurate anatomical reduction and rigid internal fixation if joint function is to be restored. Open reduction and the use of a transcondylar lag screw is the main method of repair. In addition antirotational devices (K-wire or screw) should be placed in the epicondylar region. Some 77% of dogs treated for lateral or medial condylar fractures go on to regain normal limb function with an average recovery time of 4 weeks, (Denny , 1983).
Intercondylar (Y or T) fractures require good exposure to achieve accurate anatomical reconstruction of the articular surfaces. Although a caudal transolecranon approach has been popular (Bardet et al 1983, Anderson et al 1990) a combined medial and lateral aproach (McKee et al 2001) is now routinely used. The medial condyle is reduced first and attached to the humeral diaphysis using a plate or occasionally K-wires in immature dogs , the dog is then turned over and a lateral approach is used to reduce the lateral condyle which is fixed with a transcondylar lag screw + antirotational K-wire.
Prognosis is favourable for return to reasonable function in the majority of animals (64-70%) provided accurate anatomical reduction and good stability is ensured allowing early pain –free elbow mobility (Denny , 1983 ; Anderson et al 1990., 1990 McKee et al 2001)

Medial epicondylar fractures.

This uncommon injury is seen predominantly in immature dogs and results from falls or road traffic accidents. The fragment is distracted by the pull of the antebrachial muscles. If the fragment is large it is re-attached with a lag screw or tension band wire. Smaller bone fragments can be removed and the muscles re-attached to the adjacent fascia

Fractures of the proximal ulna and olecranon

Fractures of the proximal ulna can be divided into articular fractures involving the semilunar notch of the ulna , or avulsion fractures involving the olecranon process (Muir & Johnson , 1996). In both fracture types the olecranon process is distracted by the strong pull of the triceps group of muscles. Internal fixation using the tension band principle is essential. Tension band wiring with the wire placed over the caudal aspect (tension side) of the ulna is used in most cases however in the case of comminuted fractures of the olecranon a plate is used for fixation . Ideally it is placed on the caudal aspect of the ulna but if this is not possible the lateral side is used.
Small avulsion fractures of the proximal olecranon are treated by lag screw fixation or wiring techniques.
Exposure of the olecranon and proximal ulna shaft is achieved through a curved caudolateral incision made directly over the olecranon. The extensor carpii ulnaris muscle and the flexor carpi ulnaris muscle are separated and retracted to reveal the shaft of the ulna.

Fracture of the anconeal process

Fracture of the anconeal process , not to be confused with un-united anconeal process, is occasionally encountered(McCartney , 1993). Ideally , these cases are treated by lag screw fixation. Anconeal process fracture can also occur as a complication of comminuted fractures of the olecranon.

Fractures of the radial head

Fractures of the radial head are rare , they are often articular and can be associated with fractures of the ulna and elbow luxation. Management has been described by Neal (1975). Articular fractures require accurate anatomical reconstruction and fixation with lag screws and K- wires . Salter Harris Type 1 fractures require K - wire fixation if displaced.

Luxation of the humeroantebrachial joint.

Traumatic luxation (dislocation) of the elbow is uncommon , the injury is usually seen in dogs and cats over 1 year of age. This injury results from involvement in road traffic accidents or when the animal catches its leg in a fence and is suspended by the limb. The exact mechanism by which luxation occurs is still open to question however the end result is lateral displacement of the radial head in relation to the humerus. After luxation of the elbow the leg is held forward in semiflexion, with the lower limb abducted and supinated. The elbow joint will be obviously deformed and painful. Flexion and extension are limited.

In the radiographic diagnosis both mediolateral and craniocaudal views should be taken noting any bone fragments which may be associated with collateral ligament avulsion . Closed reduction should be carried out as soon as possible after the accident. Reduction is achieved under general anaesthesia. The elbow is fully flexed and then the radius and ulna are rotated medially .The elbow is slowly extended until the anconeal proces is re-engaged in its normal position between the humeral epicondyles. If the manipulation is successful the radial head and anconeal process “snap “ back into place , a normal range of elbow movement is restored and the joint should feel stable. Following radiography to confirm reduction , a Robert Jones Bandage is applied for 7-10 days and exercise is restricted for 4 weeks. Most cases make a satisfactory recovery following closed reduction but, in the long term secondary osteoarthritic change is common (Billings & others, 1992). Following reduction the collateral ligaments are checked damage for damage by palpation and /or radiographs. If the collateral ligament is avulsed from the humerus it is re-attached using a bone screw + spiked washer. If the ligament is ruptured primary repair should be attempted. Alternatively stability can be restored by replacing the medial collateral ligament with a figure -of-eight heavy gauge braided polyester suture (7 metric Ethibond , Ethicon), or a monofilament material such as Leader line, anchored by two suture screws , one placed in the medial aspect of the humeral condyle and the other in the ulna.

In longstanding , neglected elbow luxations open reduction is carried out in two stages. First a lateral approach is used to allow release of fibrous adhesions so that the radial head and anconeal process can be levered back into their normal position using an elevator in the joint space. After closure of the lateral wound the medial side of the elbow is exposed and the joint stabilised by replacing the medial collateral ligament with a prosthesis.

Results of treatment .In a study of 31 dogs with elbow luxations by Schaeffer & others (1999) it was concluded that a good outcome is likely following early closed reduction provided joint stability is adequate. More proactive use of surgery to restore collateral ligament stability is likely to increase the chances of a successful outcome when instability is noted following closed reduction.

Cranial luxation of the radial head in cats.

Cranial luxation of the radial head , associated with rupture of the annular ligament, is occasionally seen in cats. Open reduction is performed and the radial head fixed to the ulna with a lag screw. Prognosis is good , normal function is usually regained and the screw can be left in situ

Monteggia fracture /luxation

Fracture of the ulna with cranial luxation of the radial head is known as a 'Monteggia' fracture (Boyd & Boals, 1969 ; Schwartz & Schrader , 1984). Cranial luxation of the radial head occurs when the annular ligament , which normally binds the radial head to the ulna , ruptures and the ulnar shaft is fractured just distal to the elbow. Provided the injury is recent, the luxation can be reduced by manipulation and , because of the strong interrosseous attachments between radius and ulna, reduction can be maintained simply by stabilising the ulnar fracture. This is achieved with an intramedullary pin and tension band wire , or a plate if the fracture is comminuted.

Avulsion and ruptures of the tendon of insertion of the triceps muscles

Avulsion or ruptures of the triceps tendon of insertion are occasionally encountered in dogs and cats. Although trauma is the usual cause, the condition has also been reported as a complication of local steroid injection(Davies & Clayton Jones , 1982). Following avulsion , the leg is carried in a semiflexion, the animal is unable to extend the elbow and there is a painful swelling over the point of the olecranon. Repair of the tendon is achieved with Bunnell or Pennington-type locking loop sutures of monofilament nylon . In avulsions, if bone fragments remain with the tendon ,a tension band wiring technique is used for re-attachment, alternatively a tunnel is drilled transversely through the olecranon to allow attachment of suture material between tendon and bone. Post operatively the elbow should be kept in extension for 4-6 weeks using either Robert Jones bandage or transarticular fixator.

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Hereditary aspects of ED and ED-screening protocol

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Introduction

The International Elbow Working Group has learned from the world wide experiences in screening for hip dysplasia (HD). Apart of the lack of agreement on radiographic protocols there is also a lack of agreement on interpretation and grading for HD, despite the effort of the Federation Cynologique International (FCI) to make the final scores comparable all over Europe. This is due to the fact that the acceptance of the quality (positioning and exposure) and amount (position with extended femores, sometimes in addition ffrog leg position) of the films, but also the grading of the amount of laxity (either natural or forced outside the acetabuli), acetabular depth and osteophytes are less well harmonized. In some countries one person judges (per breed or per kennel club), whereas in other countries three screeners grade the radiograph – at the same time or in sequence- to come to a final scoring. The different national breeders clubs are organising the HD-screening, influenced by the large breeders of whom sometimes the interests in screening results for HD are not parallel to the interest of the breed on the long run; as a consequence more often it seems that those breeder clubs chose for simple, cheep and quickly (one radiograph of any quality screened by one), with all consequences connected to that. Due to the lack of harmonisation of the method and the historical deviation of national grading schemes, a certificate for HD is for breeders and veterinarians very unclear and sometimes misleading.

Screening for ED

The screening for ED differs also in different European countries as far as accepting quality and quantity of radiographs, and the judging (individual or panel) is concerned, whereas the method of screening is harmonized by the International Elbow Working Group (IEWG, see http://www.vetmed.ucdavis.edu/iewg/iewg.htm). The early recognition by the founders of the IEWG to harmonize the grading system gives a much better start than the individual or national HD-scoring systems. The IEWG is very grateful to the WSAVA to be a affiliate association of this world wide veterinarian organisation. The IEWG is now in a process to get a certificate functioning in the veterinary world where the grading for OA is given per elbow joint as well as the possible different forms of ED as visible on the radiograph(s) (i.e., fragmented coronoid process [FCP], osteochondrosis/itis dissecans [OCD], joint incongruity [INC], and ununited anconeal process [UAP]). Since in some countries ED screening is performed on one view (ML-flexed), whereas in other countries more views are obliged in order to have a lower false negative scoring rate and to visualize entities which are not visible on the ML view alone (e.g. OCD of the medial humeral condyle), the certificate gives insight to the buyer or kennel club which views were used for screening, in order to take this into account when comparing different dogs screened by different systems.

Although breed clubs and national kennel clubs take the initiative to screen for ED and HD as well as for other skeletal and non-skeletal hereditary diseases, this does not imply that all dog owners cooperate without hesitation. They criticize the limited success rate of screening for decades, without realizing that it is not the screening but rather the consequences drawn from it, which can make the difference. In addition, whole series of unacceptable tricks are in use to earn a better score for the dog, without taking the influence on the breed into account. Due to the old fashioned (i.e., with plane radiographs)

and limited (only one view) techniques many positives will be missed, in addition to the dogs with the negative phenotype but positive genotype raised under optimal environmental circumstances. Only for some breeds there is insight in the h^2 for elbow dysplasia, and even less for the different entities. Guthrie and Pidduck (1990) published a h^2 of 0.77 and 0.45, respectively, although Studdert et al (1991) published a lower h^2 (0.27) for the latter breed. A h^2 above 0.2 for ED suggests that genetic selection should be effective to improve the medium value within the breed. Long term follow-up studies, both in dogs with different grades of HD as in dogs with or without ED have shown the benefit of breeding programs and the detrimental effects when dogs with ED or HD were used. The only way to overcome the disadvantage of screening the phenotype with a technique of low precision to rule out the genotype of skeletal diseases like ED is to develop DNA-screening tests. These tests will allow for excluding homozygote positives from breeding, followed by excluding the heterozygotes when the breeding stock allows for.
To investigate the involved gene(s) coding for FCP, DNA samples of Labradors have been collected from complete litters which were also radiographed for ED. The diagnosis FCP has been confirmed in these dogs by surgery. From these dogs we selected 13 families with at least two affected siblings. The new method of sib-pair analysis was used to investigate the linkage of candidate genes to the phenotype of FCP, making use of the Mendelian rule stating that two siblings share on average 50% of their alleles, however in a gene locus responsible for a disease, affected siblings will share more than 50%. This principle was used to test the candidate genes for FCP. Since histological scans of FCP show defects in the collagen development of the joint, genes coding for collagen constituents were selected as appropriate candidate genes. Affected littermates shared approximately 50% of alleles of markers close to the collagen genes COL1A1, COL1A2, COL2A1 as well as VDR, ruling out a role for these genes in FCP (Salg et al, 2004). Additional candidate genes are investigated, making use of the knowledge about the dog genome, which became available recently. The DNA-screening method needs a lot of investment in time and money (we acknowledge the cooperation of the Royal Netherlands Blind-guide dog Association and Hill's Pet Food for their financial support in this study), but may finally lead to a precise testing, irrespective of the age of the animal, the quality of the radiographs or the tricks to cover ED for screening.

Till this and other tests 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 it transparent how the animal has (not) been screened. Veterinarians associated with the WSAVA are in the strong position to implement the certificate 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.

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Elbow screening protocol: http://www.vetmed.ucdavis.edu/iewg/iewg.htm
The members of the extended board of the IEWG are acknowledged for their effort over the last 5 years to develop the certificate as presented here to the WSAVA-members.

Breeding for improved hip and elbow status in Swedish dogs

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Introduction

Central evaluation and registration of hip and elbow status has been organised by the Swedish Kennel Club (SKC) for many years[1]. Grading of elbow dysplasia (ED) is done according to the guidelines of the International Elbow Working Group (IEWG) and radiographs from hip screening are evaluated as approved by Fédération Cynologique Internationale (FCI). Records from hip and elbow screening are registered by the SKC for all breeds. In 1988 a formal elbow screening program was instituted for the Rottweiler and Bernese Mountain Dog[2], the program also implies that elbow status of both the sire and the dam should be known if the progeny are to be registered by the SKC. Today, another six breeds have been included in the screening programme for ED. A similar screening program also exists for hip dysplasia (HD) and includes over 100 breeds.

In most grading systems based on degree of abnormality, there are limited possibilities for measuring differences among phenotypically normal (non affected) dogs[2]. Dogs free from hip or elbow dysplasia are therefore lumped together in one class even though their true breeding values might differ. In some breeds, a large proportion of the dogs are graded as phenotypically normal and only dogs free from dysplasia are used for breeding. This makes selection based only on the individual's own screening record ineffective.

Several studies have shown that the phenotypic value is affected by various systematic environmental factors, such as gender and age at screening[2,3,4]. Furthermore, proof has been presented that also the chemical restraint, used for sedation prior to screening, can affect the evaluation of hip and elbow status[5,6]. The reason for this could be that more heavy sedation gives a greater muscle relaxation and allows a hidden joint laxity to appear.

Estimation of breeding values for HD and ED based on own and relatives screening records would make it possible to differentiate between non affected dogs and to adjust for systematic environmental effects. The accuracy of evaluation would increase and the limitations from using phenotypic mass selection would be overcome.

The aims of the present studies are to get a better knowledge of environmental and genetic factors influencing hip and elbow dysplasia and to develop a model for estimation of breeding values for these traits.

Materials and methods

Based on a questionnaire study of routines for hip and elbow screening used in Swedish veterinary clinics and hospitals, analyses was made of whether the type of chemical restraint used for sedation affected the screening result for hip and elbow joints. In total, 5878 records of HD and 5407 records of ED for dogs of eight different breeds, examined in 174 clinics, where included in the study. To examine the impact of sedation method on HD and ED analysis of variance was made using Proc GLM[7]. The fixed effects of sex, breed, sedation method and veterinary clinic were included in the model.

Additionally, genetic analysis and estimation of breeding values for HD and ED has been made for two breeds; Rottweiler (RW) and Bernese Mountain Dog (BMD). The data consisted of screening results and pedigree information from the SKC. In total, records of hip joint status for 14711 RW and 8236 BMD and elbow joint status for 11 098 RW and 7977 BMD were included in the analyses. Genetic parameters and breeding values for HD and ED were estimated by Best Linear Unbiased Prediction (BLUP) using an AI-REML approach with the DMU program[8]. An animal model, including the fixed effects of gender, birth month, age at screening, panelist and a combined effect of clinic and year of examination, was used.

Results and discussion

More than 80% of the dogs had been sedated either with Domitor® vet. (Orion) or a combination of Domitor® vet. and Torbugesic-SA® (Wyeth) prior to hip and elbow screening. Sedation with Plegicil® vet. (Pharmaxim Sweden AB) was used for 10% of the dogs in the data set. For the remaining dogs, Rompun® vet. (Bayer AB) or some other chemical restraint had been used. The distribution of hip status in the different subgroups for sedation method showed that dogs sedated with Plegicil ® vet. had the lowest frequency of HD (15%). Sedation with Domitor® vet. and Domitor® vet. in combination with Torbugesic-SA® both gave HD frequencies of 30%. Analysis of variance showed that dogs sedated with Plegicil ® vet. had a significant lower frequency of HD. However, for ED differences in frequency between the subgroups for sedation methods were smaller. Sedation with Plegicil® vet. gave the lowest frequency of ED but the difference was not found to be statistically significant.

The genetic analyses gave heritability estimates for HD and ED in a range of 0.35 – 0.38. These estimates are in agreement with those from other studies[2,3,4]. The genetic correlation between HD and ED was 0.19 ± 0.05 for RW and -0.01 ± 0.06 for BMD. This indicates that selection against HD could be expected to decrease the prevalence of ED only to a minor extent, and vice versa. Estimated breeding values showed that the genetic improvement for HD and ED during the last 20 years was in accordance with what can be expected from selection based on phenotypic values. A faster genetic progress will be possible if selection is based on estimated breeding values instead of phenotypic values. The observed variation in breeding values for HD and ED indicates that phenotypically equal individuals can be distinguished based on their estimated breeding value.

Registration of sedation method used for hip screening has now become mandatory in Sweden. This makes it possible to adjust for the effect of sedation method in a future model for estimation of breeding values for hip dysplasia.

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Growth and development of the medial coronoid process of retrievers

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In this presentation the growth and development of the medial coronoid process in the elbow of retrievers will be discussed, and a case of ‘silent’ osteochondrosis on the location where FCP can be expected, will be presented. It appears that the coronoid process is substantially loaded from six weeks of age, and that tensile forces exerted by the anular ligament have an influence on the trabecular structure of the coronoid process. The subchondral bone layer, important for resistance of loading and support of the articular cartilage, develops rather late. Furthermore, at least three cartilage canals, which are thought to play a role in the development of osteochondrosis, are present until the age of thirteen weeks.

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	Jeruzalem [cancelled]
1997	Birmingham
1998	Bologna
1999	Orlando
2000	Amsterdam
2001	Vancouver
2002	Granada
2003	Estoril
	Bangkok

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