

PROCEEDINGS

**25th annual meeting of the
INTERNATIONAL ELBOW WORKING GROUP**



**Thursday September 16th 2010
Bologna Fiere Congress Centre
Bologna, Italy**

Welcome at the International Elbow Working Group meeting-2010

Dear participants.

The Board of the International Elbow Working Group likes to welcome you at the annual meeting, organised in conjunction with the World Veterinary Orthopaedic Congress (WVOC), which is the third joint meeting of the European Society for Veterinary Orthopaedics and Traumatology and the American Veterinary Orthopaedic Society. The Board of the IEWG is grateful for the opportunity offered by the WVOC congress committee and the sponsors Hill's Pet Food and Boehringer-Ingelheim to have this IEWG meeting in the pre-congress program of the prestigious WVOC-meeting where all famous scientists in veterinary orthopaedics meet the practising veterinary surgeons and orthopaedic specialists.

The IEWG has been founded 21 years ago by veterinarians and breeders who had concern about the increasing number of dogs suffering from elbow dysplasia. They initiated an annual meeting where the latest information on radiological screening and hereditary aspects are discussed with all those interested and involved in dog breeding and breeding stock screening. The conjunction with the WVOC gives the nice opportunity that those who are also interested in surgical treatment can be updated by world famous specialists. That is the reason why the IEWG had decided to choose for the WVOC congress rather than for the World Small Animal Veterinary Association (WSAVA) congress as is normal the hosting meeting for the IEWG. The IEWG is an affiliate of the WSAVA, facilitating to spread the IEWG insights around in the veterinary world.

The IEWG has developed a screening system which takes both the severity of osteoarthritis into account as the primary causes of elbow dysplasia. The completeness of the screening on primary and secondary signs depends on the amount of radiological views which form the base of the screening system. It is not only the quality of the radiographs but also the quantity of views which help to form a complete diagnosis. The more complete the diagnosis the more precise the potential breeding stock can be selected. There is enough evidence that strict selection will consequently decrease the amount of dogs born with elbow dysplasia's in those breeds where the breeders club subscribe the screening system. Since the amount of views has a direct influence on the final score, IEWG developed a registration form which includes information of the dog involved, its owner and the veterinarian who made the radiographs as well as the (amount of) views which were used for screening, and finally the OA-scoring and the primary diseases scoring and consequently the ED-scoring. The registration form, which goes herewith, makes international communication among breeders and veterinarians possible and transparent for the customer and the national breeders club from the country of the new owner.

It is the mission of the IEWG to educate veterinarians in European countries and abroad about the aetiology, the clinical and radiological signs of all different forms of elbow dysplasia and to instruct veterinarians involved in the screening of breeding dogs. In addition surgical and medical treatment, arthroscopy, and other aspects of interest will be presented at the IEWG-2010 meeting.

We wish you a fruitful meeting with interesting interaction with faculty as well as with fellow veterinarians with concern about and interest in elbow dysplasia in dogs.

Prof. dr. H.A.W. Hazewinkel, president,
Dr. B. Tellhelm, treasurer,
Dr K.L. How, secretary

The International Elbow Working Group
acknowledges the financial support by



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PROGRAMME IEWG 2010

Thursday September 16th 2010

Bologna Fiere Congress Centre

Bologna, Italy

- 08.30 – 09.00 Registration
- 09.00 – 09.10 Welcome to the International Elbow Working Group meeting
Dr. H.A.W. Hazewinkel [NL]
- 09.10 – 10.00 Clinical examination of the dog with elbow lameness
Radiographic diagnosis of Elbow Dysplasia in the dog
Dr. R. Palmer [USA]
Dr. M. Flückiger [CH]
- 10.00 – 11.00 Arthroscopy and surgical treatment of FCP/OCD
Dr. R. Palmer [USA]
- 11.00 – 11.30 Coffee Break
- 11.30 – 12.30 Treatment of elbow incongruity and UAP
Dr. B. Beale [USA]
- 12.30 – 13.00 Radiological screening according to IEWG- new insights
Dr. B. Tellhelm [D]
- 13.00 – 14.00 Lunch
- 14.00 – 14.15 Free communication
Evaluation of incongruencies in the canine elbow with FCP by a
standardized X ray method in dogs
Dr. I. Pfeil [D]
- 14.15 – 14.30 Free communication
Compartmental Bone Induction Stimulus (COBIS) for early treatment
of osteochondral disease [coronoid disease, OCD]
Dr. P. Kramers [CH]
- 14.30 – 16.00 Film reading session: training how to score radiographs of elbows
according to IEWG guidelines [simultaneous translation in Italian]
Dr. M. Flückiger [CH]
Dr. E. Auriemma [I]
- 16.00 – 16.30 Osteoarthritis treatment in dogs
Dr. B. Peirone [I]
- 16.30 Closing

List of speakers

Dr. B. Beale, DVM, Diplomate ACVS,
Gulf Coast Veterinary Specialists,
Houston, Texas, USA.

Dr. M. Flückiger, Prof., Dr. med. vet., Diplomate ECVDI.
Dysplasia Committee Zürich,
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Dr. H.A.W. Hazewinkel, Prof., DVM, PhD, Diplomate ECVS, Diplomate ECVCN.
Department of Companion Animal Sciences,
Faculty of Veterinary Medicine Utrecht University,
PO box 80.154,
3508 TD Utrecht, The Netherlands.

Dr. P. Kramers, Dr. med. vet. , Diplomate ECVS,
Kleintierpraxis Kugeliloo,
Zürich, Switzerland.

Dr. R. H. Palmer, DVM, MS, Diplomate ACVS.
Ass. Professor – Orthopedic Surgery; Affiliate Faculty – School of Biomedical Engineering.
Colorado State University, USA.

Dr. B. Peirone, Prof, DVM, PhD
School of veterinary medicine
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Dr. I.Pfeil, Dr. med. vet., Fachtierarzt für Chirurgie & Kleintiere .
Tierärztliche Klinik Dresdner Heide,
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Dr. B. Tellhelm, Dr. med. vet., Diplomate ECVDI,
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Clinical examination of the dog with elbow lameness

Dr. R. H. Palmer, DVM, MS, Diplomate ACVS.

Ass. Professor – Orthopedic Surgery; Affiliate Faculty – School of Biomedical Engineering.
Colorado State University, USA.

Introduction

Elbow dysplasia (ED) includes medial coronoid process disease (MCPD), osteochondritis dissecans (OCD) of the medial aspect of the humeral condyle, ununited anconeal process (UAP), ununited medial epicondyle (UME) and various forms of joint incongruity (radio-ulnar length discrepancy and humero-ulnar incongruity). Early detection of elbow dysplasia is the key to maximizing treatment outcome, but requires that we develop an “index of suspicion” based upon patient signalment, history, physical examination findings, and supportive radiographic findings.

SIGNALMENT & HISTORY

While MCP disease can affect most any medium and large breed of dog, certain breeds such as Golden Retrievers, Labrador Retrievers, Rottweilers and Bernese Mountain dogs are so commonly affected that they raise our “index of suspicion”.

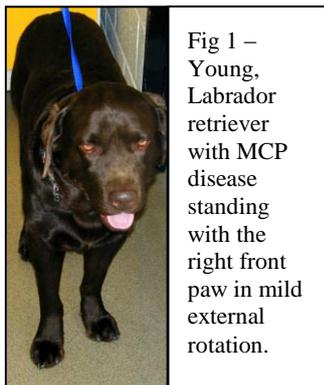


Fig 1 – Young, Labrador retriever with MCP disease standing with the right front paw in mild external rotation.

Similarly, UAP is commonly diagnosed in German Shepherds. Nonetheless, pursuit of elbow dysplasia as a differential diagnosis is warranted if the gait and physical examination findings are supportive even though the breed of dog is not thought of as “classic”. Puppies may present for thoracic limb lameness, stiffness, exercise intolerance, or non-specific mobility problems as early as 4 months of age. In addition, even middle-aged and elderly adult dogs can present for thoracic limb lameness caused by elbow dysplasia without a history of lameness at a younger age.

GAIT

Many puppies with elbow dysplasia stand with their paws externally rotated (supination). The severity of lameness can vary from extremely subtle to obvious “head-bobbing” lameness. Having the patient descend stairs may be helpful in exacerbating subtle lameness.

PHYSICAL EXAMINATION

Joint effusion is most easily detected in the standing patient as a puffy, fluid-filled pouch between the lateral epicondyle and the olecranon (Fig 1).

It is important to gain the patient’s trust before one can expect to attain a reliable indication of pain during the examination. Normally, during elbow flexion, puppies can place their distal antebrachium against the point of their shoulder with no discomfort. When elbow flexion is painful, dogs resist flexion or pull their shoulder joint dorsally to relieve the elbow flexion. As OA progresses, elbow flexion is physically restricted by osteophytosis and/or periarticular fibrosis. Normal puppies can extend their elbow with no discomfort and display only mild discomfort upon forced, full elbow extension. The elbows should specifically be tested in pronation and in supination as this is not painful in most normal puppies, but puppies with ED will usually display some discomfort.

Fig 2 – Joint effusion is visible and palpable as a soft, fluctuant fluid pocket (oval zone) between the lateral epicondyle (*) and the olecranon



Likewise, many puppies with MCPD are uncomfortable when digital pressure is applied directly over the MCP.

Reference Reading

1. Vet Surg 2006;35: 501-509.
2. Vet Comp Orthop Traumat 2008;21: 106-109.
3. Vet Surg 38:144-153, 2009.
4. Vet Surg 38:199-208, 2009.
5. Vet Surg 38:209-212, 2009.
6. Vet Surg 38:213-223, 2009.
7. Vet Surg 38:285-300, 2009

Radiographic Diagnosis of Elbow Dysplasia in the Dog

(Requirements for the IEWG standardized screening procedure, updated version 2010)

Dr. M. Flückiger, Assoc. Prof., Dr.med.vet., Diplomate ECVDI,
Dysplasia committee, University of Zurich, Switzerland.

Radiographic technique

1. Minimal age for routine screening is 12 months
Some breed-clubs have issued specific requirements!
Elbow lame dogs should get radiographed at any age
2. Both elbows are radiographed
3. Rare Earth screens with a speed of 200 or less are recommended
4. The elbow is placed directly on the cassette, no grid is used for the examination
5. The beam is collimated to improve image quality (not applicable when using CR or DR)
6. For the mediolateral projection the elbow is flexed (45° opening angle between humerus and radius), resulting in concentric superimposition of the humeral condyles. Good results are achieved with a 50 – 60 kV-setting.
7. The MCP is best identified with the limb extended and 15° supinated. An additional craniocaudal view with 15° elbow pronation is 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 are screened for elbow disease by qualified persons, preferably ECVDI/ECVS or ACVR/ACVS diplomates. 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
- united anconeal process
- osteochondrosis of the medial humeral condyle
- marked incongruity of the articular surfaces such as radio-ulnar length discrepancy and humero-ulnar incongruity (step formation, subluxation)

Further findings (of unknown etiology and relevance) may be

- mineralisation of periarticular tissue (flexor tendon at medial humeral epicondyle)
- DJD resulting from unknown origin
- any other abnormality noted

Normal elbow joint, radiographs



mediolateral view, 45 ° flexed

Primary ED-Lesions (IEWG)

- Fragmented medial coronoid process (FCP)
- Osteochondritis (dissectans) medial humeral condyle (OCD)
- Ununited Anconeal process (UAP)
- Severe Incongruity/step between radius and ulna (Inc)

cranio-15°lateral-caudomedial view
(i.e. craniocaudal projection, 15°
pronation)



Radiographic findings indicative of FCP



Mediolateral radiograph (not all features may be noted!):

- Blurred and deformed contour of medial coronoid process. A fragment is rarely seen!
- Increased subchondral bony opacity (sclerosis) in distal part of semilunar notch, and loss of trabecular pattern. (Sclerosis is rarely noted in German Shepherd dogs with FCP!)
- Step between radius and ulna
- 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 (not all features may be noted!):

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

Beware of artifact: The sagittally running radiolucent line within the MCP usually represents the edge of the ulna and not a fissured PCM!

Findings with OC/OCD (Osteochondrosis, Osteochondritis dissecans) or contact lesions



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 detached bony fragment is rarely visible
- The 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
- In some dogs only a patchy irregularly mineralized AP is noted
- Irregular subchondral sclerosis
- Progressive DJD depending on duration of process

Scoring (updated 2010)

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
1	Mild arthrosis	Presence of osteophytes < 2 mm high Suspect sclerosis of the base of the coronoid processes
2	Moderate arthrosis or suspect primary lesion	Presence of osteophytes of 2 - 5 mm high Obvious sclerosis of the base of the coronoid processes Step of > 2-5 mm between radius and ulna (suspect INC) Suspect presence of a primary lesion (UAP, FCP, OCD)
3	Severe arthrosis or evident primary lesion	Presence of osteophytes of > 5 mm high Step of > 5 mm between radius and ulna (obvious INC) Obvious presence of a primary lesion (UAP, FCP, OCD)

A Borderline (BL) score between ED 0 and ED 1 is allotted to dogs with minimal anconeal process modelling of undetermined aetiology in some countries.

Differential diagnoses (a selection)

Common

- Panosteitis (Enostosis)

Less common

- Premature closure of a growth plate (usually distal ulna, traumatic in origin)
- Non-traumatic short ulna syndrome or elbow malformation in chondrodysplastic dogs (Basset, Welsh Corgi, and other breed)
- Avulsion of flexor muscle origin at medial epicondyle
- Mineralisation (metaplasia) of flexor origins
- Trauma induced elbow arthrosis

Rare

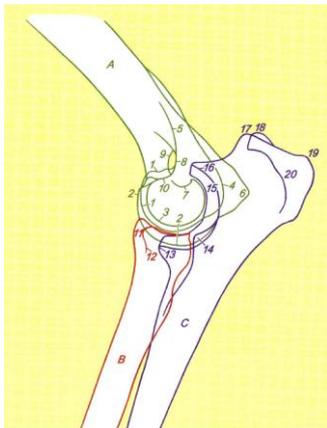
- Osteomyelitis
- Septic arthritis
- Hypertrophic osteodystrophy
- Incomplete ossification of the humeral condyle (IOHC)
- Mineralisation of extensor muscle origin at lateral epicondyle
- Congenital elbow luxation with lateral displacement of the radial head

References

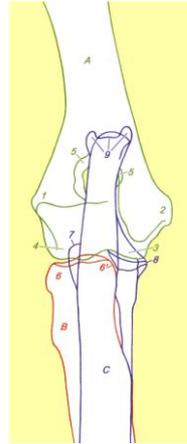
- <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi> (Enter: Elbow dysplasia canine)
- Morgan JP, Wind A, Davidson A: Hereditary bone and joint diseases in the dog, schlütersche 2000.

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

mediolateral view



craniocaudal view



Legend

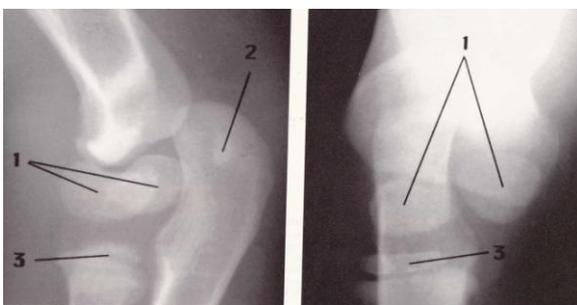
A Humerus, B Radius

- 2 medial humeral condyle
- 4 lateral epicondyle
- 6 medial epicondyle
- 13 medial coronoid process
- 14 lateral coronoid process
- 16 anconeal process

C Ulna

- 3 medial humeral conyle
- 7 lateral coronoid process
- 8 medial coronoid process

Ossification centers in the elbow joint of a puppy



Ossification centers of 1 humeral condyle, 2 medial epicondyle (anconeal process not yet visible!), 3 proximal radial epiphysis.

Arthroscopic and Open Surgical Treatment of MCPD/OCD

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Introduction

The most commonly treated manifestations of canine elbow dysplasia (CED) include medial coronoid process disease (MCPD), osteochondritis dissecans (OCD), and ununited anconeal process (UAP). Even within a single manifestation of CED, there is a wide spectrum of pathology and clinical presentations. Therefore, a similarly wide array of potential treatment options is available. The biggest challenge facing the veterinarian is selection of the appropriate treatment rather than the actual technical performance of it.

Medial Coronoid Process Disease (MCPD) Overview

Fragmented medial coronoid process (FMCP) is more properly referred to as MCPD since advanced CT imaging and histopathologic analysis have shown that advanced disease may be present without gross MCP fragmentation. Formation of subchondral bony microcracks, characteristic of local fatigue failure due to mechanical overload, precedes the onset of cartilage pathology.¹ Some patients have little apparent cartilage pathology during joint exploration in the face of relatively severe subchondral bony pathology. Thus, close scrutiny of high quality radiographs or better yet, computed tomography images, is an important pre-operative assessment. The same report also showed that subchondral bony pathology exists in grossly intact regions of the MCP adjacent to obvious fragmentation¹; this finding implies that simple fragment removal, via arthrotomy or arthroscopy, may be an incomplete treatment.

Medial “Mini-Arthrotomy” for Treatment of MCPD

Population statistics suggest that, overall, surgical management offers better outcomes than medical management alone, though this is certainly not true for every individual clinical patient.² An algorithmic approach to preoperative decision-making has recently been proposed.³ Even when surgical treatment is pursued, lifelong multimodal medical management is essential because no surgical treatment for CED is curative. Comprehensive medical management includes maintenance of lean body conformation through caloric restriction, a lifestyle of regular, moderated activity, an OA-therapeutic diet, use of high-quality, disease-modifying osteoarthrosis agents, physical therapy / rehabilitation and, in some cases, non-steroidal anti-inflammatory drugs and/or adjunctive systemic analgesic medication.

While not curative, early surgical treatment to mitigate the symptoms of pain, lameness, and stiffness is often indicated.³ MCPD can be treated via “mini-arthrotomy” (preserves the integrity of the medial collateral ligamentous constraint) or arthroscopy. Arthroscopic evaluation and treatment of elbow dysplasia has many inherent advantages over open surgical approaches. Nonetheless, arthroscopy is not available to all veterinarians due, in part, to the cost of instrumentation and the relatively long ‘learning-curve’ associated with developing arthroscopic expertise. Medial mini-arthrotomy can be used for treatment of MCPD via Biceps Ulnar Release Procedure (BURP), MCP fragment excision, and/or subtotal coronoid ostectomy (SCO) (Figs 1- 10).

SCO versus MCP Fragment Excision. Considerable debate exists as to the relative merits of simple MCP fragment removal versus SCO. First, this debate assumes that gross fragmentation of the MCP is present at the time of diagnosis. However, in the author's clinical experience, symptomatic patients with obvious trabecular bony remodeling (based on CT scan and subsequent histopathology) frequently have no identifiable gross fragmentation even with firm probing of the MCP under arthroscopic visualization. Accordingly, large microcracks in the subchondral trabecular bone without any visible fissuring of the articular cartilage have been reported in some less severely affected patients.¹ The fragment excision versus SCO debate also assumes that MCP subchondral bony pathology is restricted to that of the gross fragment. However, osseous microdamage is typically present in portions of the "intact" MCP adjacent to the obvious, gross fragment.¹ As such, there is support for SCO (rather than simple MCP fragment removal) in effort to more thoroughly eradicate the diseased subchondral bone of the MCP in all but the most mildly affected patients.³



Fig 1 – Arthrocentesis is typically performed at level of the “X”. Skin incision is made from the medial epicondyle, across the elbow, to a point several centimeters distal to the elbow joint.

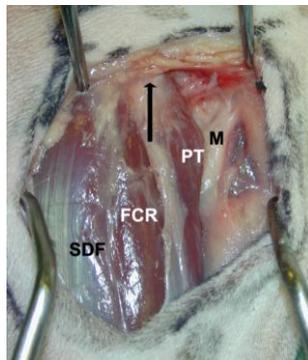


Fig 2 – Exaggerated exposure shows median n. (M), pronator teres (PT), flexor carpi radialis (FCR), superficial digital flexor (SDF), and pointed tip of medial epicondyle (arrow).

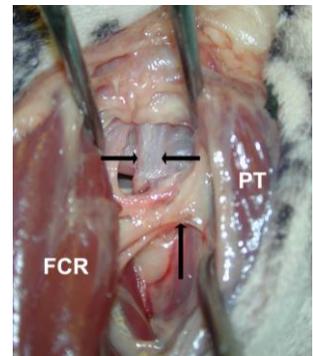


Fig 3 – Medial collateral ligament [MCL] (between 2 small arrows) and median n. (above larger arrow) are revealed by separation between PT and FCR. Mini-arthrotomy has been performed caudal to MCL.

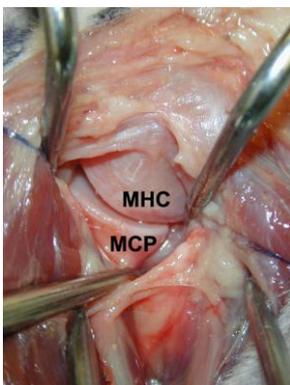


Fig 4 – Stay sutures and gelpi retractors placed in the joint capsule and medial collateral ligament (MCL). Cranial retraction of MCL reveals the MCP and medial aspect of the humeral condyle (MHC).

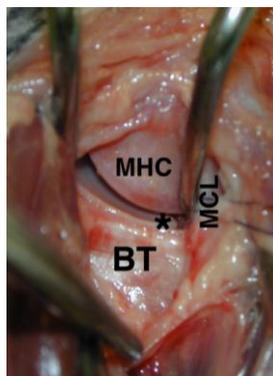


Fig 5 – BURP: The biceps tendon (BT) of ulnar insertion can be visualized along the medial margin of MCP (*) after coursing along the superficial surface of the medial collateral ligament (MCL).

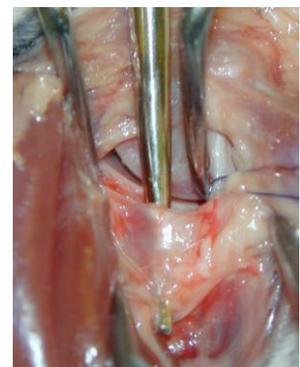


Fig 6 – BURP: A probe has been placed under the broad, fan-shaped biceps tendon prior to transecting it with a #12 scalpel blade. Care must be used to preserve the medial collateral ligament.

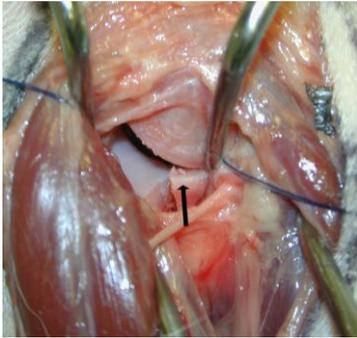


Fig 7 – SCO: Pronation and supination are used to identify the MCP and radial head. A 4mm osteotome was used to perform medial coronoidectomy. Care is taken not to remove too large a portion of the MCP initially.



Fig 8 – SCO: Anatomic elbow specimen. Dark zone depicts approximate location of initial osteotomy for medial coronoidectomy. If bone looks necrotic (yellow & avascular), small additional “slices” [light gray zone] can be made.

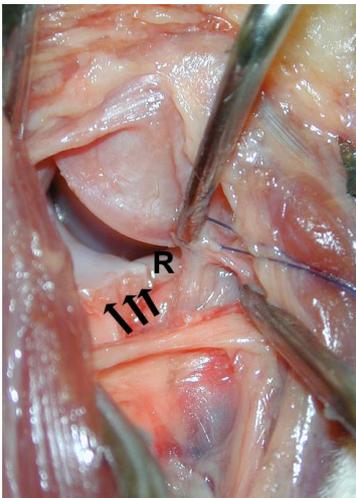


Fig 9 – SCO: The MCP was removed to reveal the osteotomy (arrows) and radial head (R). Pronation & supination of the antebrachium are used to re-identify the radial head. Joint is thoroughly lavaged.

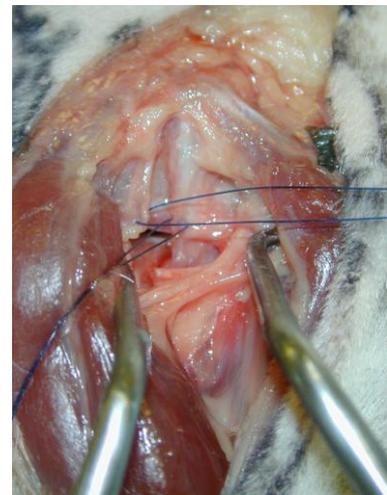


Fig 10 – The gelpi retractors were moved from an intra-capsular to an extracapsular position and the capsular stay sutures are used to bring the capsule into apposition to facilitate capsular closure. The median n. is protected.

SCO versus Load-Mitigation. Some investigators have theorized that healing of trabecular microdamage may occur if the MCP can be shielded from mechanical overloads, thus negating the need for SCO. As such, load-shifting osteotomies including ulnar osteotomy (high versus low; transverse versus oblique; IM pin fixation versus no fixation) and radial lengthening osteotomy may be indicated, especially when incongruity that may lead to MCP overloading is definitively documented with sensitive CT imaging and/or arthroscopic visualization. However, radio-ulnar length incongruity that led to mechanical overload of the MCP may be a transitory phase of skeletal development that has vanished by the time of MCPD diagnosis. Further, theories of “dynamic” radio-ulnar length incongruity have been proposed whereby the mechanical overload is only present during certain phases of the gait and thereby make definitive detection next to impossible. The argument of a mature interosseous ligament restricting the relative movement between these two bones challenges the dynamic overload concept. Recently, the strong supination load of the biceps/brachialis tendon complex insertion upon the ulna has been implicated as a potential cause of mechanical overload of the MCP.³ This broad, shiny white tendon complex inserts upon the ulna just distal to the articular margin of the medial surface of the MCP (Figs 5,6).

Strong tensile forces from this tendon insertion are theorized to rotate the MCP firmly against the radial head (Fig 11). Observation of the most severe pathology being present at the cranial margin of the MCP along the radial incisure lends support for this theory and is the justification behind the BURP procedure. Use of any mechanical load-mitigating procedure presupposes that the MCP is biologically capable of healing, though not all agree with this presupposition. Primary metabolic or vascular disease of the MCP has been proposed as a possible etiology of MCPD.

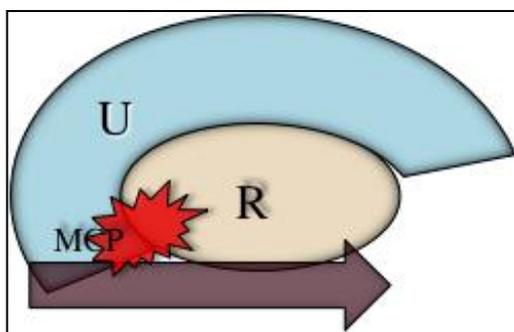


Fig 11 – Strong supination force of biceps/brachialis tendon unit insertion on the MCP is theorized to cause supraphysiologic overload of the MCP giving rise to compression of the radial incisure portion of the MCP against the radial head. Clinical observation of arcuate fragmentation patterns in the MCP radiating out from the radial incisure supports this theory.

Arthroscopy in Canine Elbow Dysplasia

Arthroscopy offers a shortened convalescence and better functional results than mini-arthrotomy, but neither method prevents the development of secondary OA.^{2,3} Recent emphasis upon minimally invasive joint surgery has brought arthroscopic elbow surgery to the forefront. Illuminated and magnified arthroscopic visualization and photodocumentation of the elbow provides great insight into the severity of the disease.

With regard to elbow dysplasia, arthroscopy can be used to assess synovitis and cartilage pathology, assess radio-ulnar incongruity, assess stability of UAP segments via blunt probing, and to excise osteochondral fragments (MCPD, UAP, OCD). More advanced arthroscopic procedures include BURP, SCO and UAP fixation techniques.

For SCO, standard medial arthroscope and craniomedial instrument portals are established. The entire tip and medial margin of the MCP are visualized. A straight mosquito hemostat can be placed on the MCP medial margin to guide introduction of a 4mm osteotome. Vertical orientation of the osteotome reduces risk of iatrogenic damage

to the medial collateral ligament. The osteotome is placed against the medial MCP edge and is directed toward the radial incisure. It is preferable to remove a relatively small portion of the MCP tip initially. An assistant gently taps the osteotome with a mallet as the surgeon maintains the orientation of the osteotome and guides it to the radial incisure being careful to avoid damage to the radial head (Fig 12). The color, consistency, and degree of hemorrhage from subchondral bone are noted as a grasper is used to remove the osteotomized MCP. Additional "slices" of MCP are made and removed until the subchondral bone appears healthy or the tolerable limit of coronoidectomy has been reached (Fig 13).

Osteochondritis Dissecans (OCD)

Osteochondrosis (OC) is a multifactorial disease with genetic, dietary, mechanical overload, endocrine, traumatic and other etiologies implicated. OC results in delayed endochondral ossification that results in thickened articular cartilage. As the deep cartilage layers fail to mineralize, they fall victim to ineffective diffusion of nutrients from the synovial fluid. Cleavage of this abnormal cartilage results in an osteochondral flap known as OCD that induces joint effusion, synovitis, subchondral edema, and degenerative joint disease that lead to pain and lameness.

OCD of medial aspect of the humeral condyle (the trochlea) is typically located adjacent to the medial coronoid process and may, at times, be confused with various "kissing lesions" associated with MCPD. Kissing lesions vary from mild edema or partial thickness abrasions/fibrillation to deep, linear abrasion tracts extending to the subchondral bone of the trochlea. In advanced cases, these linear tracts interdigitate with similar, mirror image tracts on the trochlear notch of the ulna through the limited range of extension/flexion. When true OCD of the humeral trochlea is recognized early in its progression, there may be little pathology surrounding the lesion. However, coexistence of true humeral trochlea OCD and true MCPD is not uncommon. As a result, careful preoperative imaging and surgical evaluation of the elbow joint is important. The author prefers the combination of preoperative CT followed by arthroscopic evaluation for maximal understanding of the disease processes affecting the patient's elbow joints.

When OCD of the trochlea is present without concurrent MCPD, the conventional surgical treatment is debridement of the osteochondral flap and curettage or microfracture of the underlying bed. The goal of this treatment is filling of the bed with fibrocartilage. It is well recognized that this treatment, as for surgical treatment of the MCPD, is not curative. Anecdotally, the prognosis may be worse for some of the larger (> 5mm) and deeper (>1mm subchondral bone depth) or axial lesions; the use of osteochondral autograft transfer (OAT) has been proposed for treatment of such lesions. OAT procedures utilize the impacting of a cylindrical osteochondral plug harvested from a healthy, noncontact surface, of another joint (medial trochlear region of the distal femur is commonly used) into a socket prepared at the OCD site. The short-term results of this method show some promise, but reports of long-term outcomes are lacking.⁵ Use of synthetic "cartilage substitute" plugs has also been reported and would obviate concerns of donor site morbidity.⁶

When CT imaging and arthroscopic evaluation reveal the coexistence of MCPD and OCD the treatment of choice becomes even less clear. When OAT was combined with SCO for treatment of combined OCD and MCPD, the short-term outcomes were sub-optimal. Addition of a dynamic proximal ulnar osteotomy (DPUO) oriented from caudo-proximo-lateral to cranio-disto-medial (without intramedullary pin fixation) appeared to improve the short-term outcomes of OAT/SCO treatment in a small number of patients.⁵

OCD debridement and curettage/microfracture can be performed arthroscopically. Medial “mini-arthrotomy”, as previously described, is used for OATS or OATS/SCO procedures. A caudal approach to the ulnar shaft is used for DPUO procedures.

Conclusion

Canine elbow dysplasia includes an array of disease manifestations each of which has a wide spectrum of pathology and clinical presentations. The veterinarian is, accordingly, challenged to decide which of numerous therapeutic options is indicated for a specific patient. Advanced diagnostic imaging and arthroscopic visualization have promoted a better understanding of CED and enhanced patient treatment. However, even with the most advanced diagnostic and treatment techniques, surgical treatment is not yet regarded as curative.

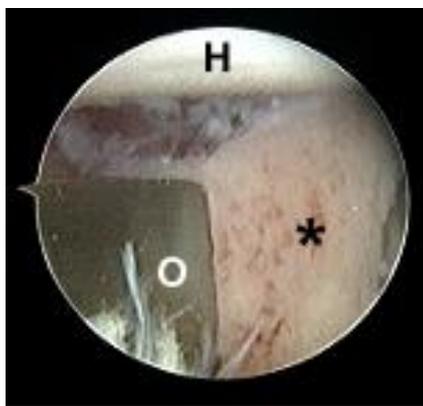


Figure 12 – Arthroscopic image of completed osteotomy [left] during SCO where O = osteotome. * = MCP osteotomy surface. H = humeral condyle. Gray zone on bone specimen [right] indicates approximate size and position of MCP osteotomy.

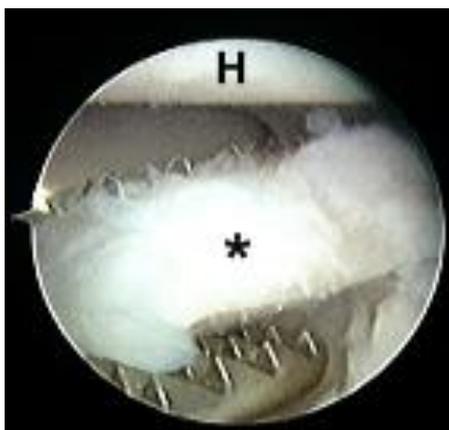


Figure 13 – Arthroscopic image of second MCP “slice” (*) in graspers [left]. After removal of the tip of the MCP [dark gray – right], light gray zone indicates approximate size and position of this slice on the MCP.

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Treatment of elbow incongruity and UAP

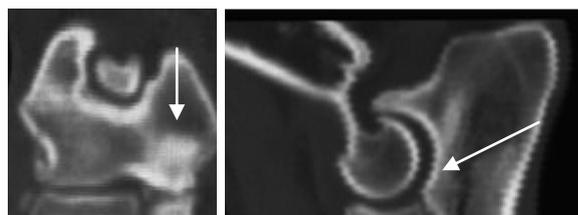
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Introduction

Elbow incongruity has a spectrum of severity. Incongruity is likely to play a role in many manifestations of elbow dysplasia including fragmented medial coronoid process (FCP), ununited anconeal process and erosion of the articular cartilage of the medial compartment of the elbow. The use of arthroscopy for diagnosis, assessment and treatment of developmental and degenerative processes of the canine elbow has become the standard of care because of improved visibility, greater surgical precision and lower patient morbidity. The use of arthroscopy for treatment of fragmented coronoid process and osteochondrosis dissecans has become routine in many surgery clinics. Arthroscopy is now being routinely used for assessment and treatment of ununited anconeal process (UAP), osteoarthritis (OA), short radius syndrome, incomplete ossification of the humeral condyle (IOHC) and lateral condyle fractures of the elbow as well.

Evaluation of Incongruity

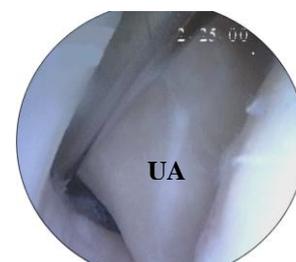
Incongruity can be evaluated by using survey radiography, computerized tomography (CT), magnetic resonance (MR) and arthroscopy. Incongruity may be observed between the humeral condyle and either the radial head or ulna. A step defect between the articular surface of the proximal radius and ulna can be seen on routine radiographic examination in some dogs. Computer reconstruction of CT images can be used to more clearly define subtle incongruity between the articular surfaces of the elbow. Arthroscopy can often best define incongruity by directly observing a discrepancy in congruency between the humerus, radius and ulna or by evaluating the wear pattern of the articular cartilage of the 3 bones. It is important to determine the area of incongruity so that an appropriate plan to manage the patient can be made.



A small step defect between the radius and the ulna is evident in this CT image. Sclerosis of the medial humeral condyle is seen due to increased forces being applied from the ulna. This patient has short radius syndrome.

Ununited Anconeal Process

Abnormalities of the anconeus region are rare except in cases of severe arthritis or in association with ununited anconeal process (UAP). The axial length of the ulna is typically shorter in patients with UAP as compared to breed matched cases without UAP. A popular hypothesis is that as growth proceeds the anconeal process of affected dogs becomes compressed against the humeral trochlea. This creates a shear force separating the anconeal process from the ulnar metaphysis. In cases of UAP, the site of non-union will be clearly visible as a radiolucent area on survey radiographs. When viewed arthroscopically, the area of non-union may appear quite quiet or may have varying amounts of fibrous tissue or fibrocartilage interposed. Cartilage erosion is also commonly seen in these patients.



An ununited anconeal process is palpated to assess stability and integrity.

Arthroscopy allows assessment of the integrity of the anconeal fragment, the degree of fragment stability and the extent of osteoarthritis. If the fragment is of good integrity, it is a good candidate for reattachment. If the fragment is remodeled and friable, removal is recommended. The stability of the fragment should also be assessed. UAP fragments that are minimally displaced and partially attached may fare well in immature dogs with proximal dynamic ulnar osteotomy only. If the fragment is mobile and displaced, it should be reattached and stabilized using a lag screw and k-wire, combined with a proximal dynamic ulnar osteotomy. Arthroscopic guidance can be used to place the k-wire and lag screw. Arthroscopy can also be used to assess reduction and compression of the fragment as the lag screw is tightened. If OA of the fragment and trochlear notch is severe, fragment removal is suggested.



A lag screw is percutaneously placed under arthroscopic visualization into the ununited anconeal process (UAP). As the screw is tightened, the fragment is lagged back onto the ulna (arrow).

Incongruity

Incongruity can be assessed using diagnostic imaging and arthroscopic observation. Radiographic signs of incongruity include step defects between articular surfaces, subchondral sclerosis of the area under excessive loads, asymmetric humeroradial and humeraoulnar joint space and varying radii of curvature of the humeral condyle and trochlear notch of the ulna. Arthroscopic evidence of



Grade 3 cartilage wear associated with chronic OA of the elbow

incongruity includes findings that would suggest increased loading of a particular region of the joint. Arthroscopic changes consistent with incongruity include fragmentation of the medial coronoid process, cartilage erosion (anconeal process, trochlear notch, medial humeral condyle, medial coronoid process, radial head), bone eburnation with groove formation and obvious step defects between the radial head and medial coronoid process and radial incisure of the ulna. Once the area of incongruity and excessive loading is identified, the surgeon can decide if a procedure can be performed to reduce the load. Modification of the load is performed in an attempt to slow progression of osteoarthritis, future fragment formation, cartilage erosion and bone sclerosis. Various techniques can be performed to modify the forces affecting the joint including subtotal coronoidectomy, dynamic ulnar osteotomy, proximal radial osteotomy, sliding humeral osteotomy and biceps tendon release. Areas of cartilage erosion can also be treated in an effort to improve the opportunity for fibrocartilage repair.

Subtotal Coronoidectomy

Subtotal coronoidectomy is a procedure designed to remove the majority of the medial coronoid process in dogs affected with elbow dysplasia and fragmented medial coronoid process. The loose fragment associated with medial coronoid process is removed. The rationale behind removal of the bulk of the remaining portion of the medial coronoid process is the presence of microfractures in the bone of the coronoid. Subtotal coronoidectomy appears to remove the portion of the bone that is susceptible to future fragmentation. This procedure is also likely to reduce load on the medial compartment of the joint due to the removal of a major weightbearing structure. Fitzpatrick showed clinical improvement in dogs affected with FCP when treated with subtotal coronoidectomy. Subtotal coronoidectomy can be performed by arthrotomy or arthroscopy using a small

osteotome, oscillating saw or burr. Morbidity is extremely low following this procedure. Dogs are returned to normal activity approximately 4-6 weeks after surgery. Subtotal coronoidectomy can be performed bilaterally during the same anesthetic procedure.

Dynamic Ulnar Osteotomy

Elbow dysplasia may be associated with a shortened radius relative to the length of the ulna. Incongruity of the joint surfaces occurs. This results in concentration of weightbearing forces on the medial aspect of the joint, leading to cartilage wear and fragmentation of the medial coronoid process and sclerosis and cartilage wear of the medial humeral condyle. The amount of shortening may vary from severe to subtle. CT evaluation is likely the best way of documenting short radius syndrome in cases of subtle shortening. When shortening of the radius becomes more marked, radiographic and arthroscopic examination can lead to a diagnosis. The goals of treatment include improved congruity of the elbow, removal of any loose intraarticular fragments and surface treatment of osteoarthritic cartilage. Improved congruity of the elbow is accomplished by dynamic ulnar partial osteotomy. A small portion of the ulna is excised, allowing improved humeroradial contact. The ulna is not rigidly stabilized in order to allow it to shift over time to the "best fit" position. Occasionally a small intramedullary pin is placed to give partial stability to decrease pain and prevent excessive caudal translation of the proximal ulna. This can be performed proximally, midshaft or distally. Morbidity is reduced the more distal the osteotomy is performed. It would seem that a more proximal osteotomy above the interosseous ligament would have a better chance of correction of incongruity, however anecdotal reports suggest distal osteotomy can also be effective. Some surgeons feel that distal osteotomy is best in immature dogs because they have a more flexible interosseous ligament. Mature dogs may require a higher osteotomy due to a more rigid interosseous attachment.



An increased humeroradial joint space is evident in short radius syndrome. Partial ulnar osteotomy allows improved congruity of humeroradial joint as the radius moves proximal following shortening of the ulna. A small IM pin can be used to decrease post-op pain.

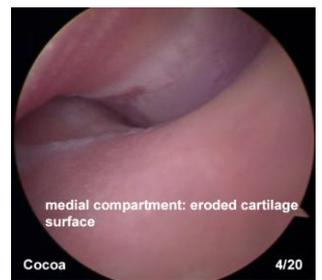
Sliding Humeral Osteotomy

Recently new procedures have been introduced to decrease the load between the medial coronoid process of the ulna and the medial humeral condyle. The sliding humeral osteotomy (SHO) was originally introduced by Schulz and was later revised and clinically evaluated by Fitzpatrick. The technique shifts the medial humeral condyle to a more medial position, increasing the load on the lateral compartment of the elbow, thereby decreasing humeroulnar conflict. The osteotomy is stabilized with a special stepped plate and locking screws (New Generation Devices, Glen Rock, New Jersey) applied to the medial surface of the humerus. The SHO is performed after arthroscopic exploration of the elbow and removal of any fragments or compromised bone of the medial coronoid process. This technique is generally used in patients having substantial cartilage wear of the medial humeral condyle and medial coronoid process. A medial approach is made to the distal humerus. The osteotomy is performed as distal as



A sliding humeral osteotomy shifts load from the medial compartment to the lateral compartment using a stepped locking plate. This technique is usually used for patients having substantial cartilage wear in the medial compartment of the elbow.

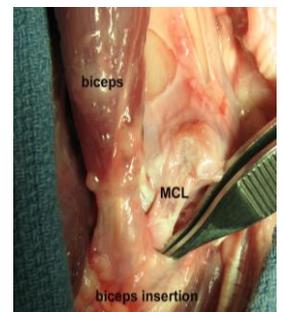
possible, but adequate room must be allowed to accommodate the plate on the distal humerus. The last screw of the plate must be positioned proximal to the supratrochlear foramen. The distal humerus is moved 7.5 or 10 mm in a medial direction. The SHO plate is applied to the humerus prior to osteotomy. After the plate is correctly positioned and secured to the proximal and distal aspect of the humerus, a humeral osteotomy is performed at the level of the step in the plate. The distal humerus is then drawn up to the plate using temporary lag screws and secured using locking screws. The SHO has recently been shown by Fitzpatrick to improve lameness in most dogs by 12 weeks following surgery. Morbidity is high following this procedure. Dogs are returned to normal activity approximately 8-12 weeks after surgery. Sliding humeral osteotomy should only be performed on one leg at a time.



Sliding humeral osteotomy is usually performed in dogs having advanced cartilage erosion of the elbow.

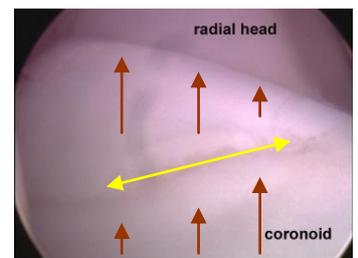
Biceps Tendon Release

The biceps/brachialis muscles constitute a large muscular complex. The anatomic origin and insertion of the biceps and brachialis muscles are such that the muscular complex exerts considerable force on the medial compartment of the elbow. The force exerted by the biceps is continuous since it is a pennate muscle with central tendon. More importantly, because the insertion of the biceps/brachialis complex is at the ulnar tuberosity, a large polar (rotational) moment is exerted at the cranial segment of the medial coronoid just caudal and distal to the medial collateral ligament. The magnitude of the polar moment is a product of the moment arm (distance



A portion of the biceps tendon inserts adjacent to the medial coronoid process.

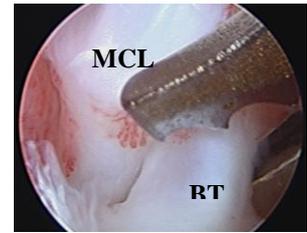
from the ulnar tuberosity to the tip of the coronoid) multiplied by the force created by the biceps/brachialis muscular complex. The polar moment rotates and compresses the craniolateral segment of the medial coronoid against the radial head. The compressive force is medial to lateral transverse to the long axis of the coronoid. A compressive force generates internal shear stress at an oblique angle to the applied compressive force. In this situation, maximal internal shear stress would be oblique to the long axis of the coronoid. Under the right circumstances, the polar moment and resultant compressive force produced by the biceps/brachialis complex may produce sufficient internal shear stress to exceed the material strength of the cancellous bone in the craniolateral segment of the medial coronoid. The result would be microfracture/fragmentation adjacent to the radial head at an oblique angle to the long axis of the medial coronoid. Interestingly, microfracture/fragmentation of the coronoid seen clinically is in the craniolateral segment of the medial coronoid adjacent to the radial head. This location corresponds to the plane of maximal shear stress generated by the compressive force exerted by the polar moment produced by contraction of the biceps/brachialis complex.



Red arrows denote compressive force generated by biceps/brachialis contraction. Yellow arrow denoted internal shear stress resulting from compressive force. Note this corresponds to the fissure line in the medial coronoid process.

Hulse et al. introduced a technique to reduce load in the medial compartment using a technique called biceps tendon release. This technique is typically used in dogs with mild to moderate cartilage wear in the medial compartment. Hulse's technique decreases the load by moving the ulnar portion of the biceps tendon to a more lateral position. The transposition of the tendon reduces the polar moment between the medial coronoid process and the radial head. The biceps release procedure can be performed open or arthroscopically. The ulnar insertion of the biceps tendon can be released and left unattached or it can be transposed and reattached to the bone in a more lateral position. The long term fate of the tendon once released is currently unknown. Care should be taken not to accidentally sever the medial collateral ligament. Morbidity is

extremely low following this procedure. Dogs are returned to normal activity approximately 4-6 weeks after surgery. Biceps tendon release can be performed bilaterally during the same anesthetic procedure.



The ulnar insertion of the biceps tendon (BT) is transected arthroscopically as a means of reducing load in the medial compartment. The medial collateral ligament (MCL) is preserved.

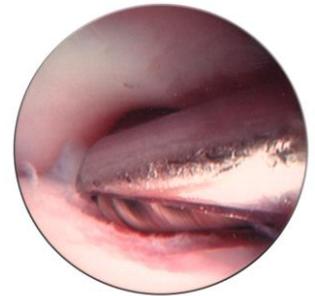
Cartilage erosion

Cartilage erosion resulting from incongruity can be treated arthroscopically using hand instruments or a motorized shaver. The goal of the treatment is debridement of necrotic cartilage, removal of sclerotic bone, neovascularization, and recruitment of pluripotential mesenchymal cells. Cartilage debridement is accomplished using a hand burr, hand curette or motorized shaver. The exposed subchondral bone can be treated using abrasion arthroplasty or micropick technique.

Abrasion arthroplasty

To perform abrasion arthroplasty, insert a hand burr or preferentially a power shaver burr through an instrument portal or arthrotomy. Either method will produce significant bone debris that can clog the egress portal and impede visualization, therefore it is important to monitor and maintain the flow of fluid through the joint during this procedure. Spin the burr to remove subchondral bone over the area of the lesion. Check for resulting bleeding frequently by stopping inflow of fluid and ensuring adequate outflow to decrease the pressure in the joint. When bleeding is observed diffusely from the lesion bed, lavage the joint to remove the remaining bone debris and close routinely.

A hand curette can also be used for surface abrasion if the subchondral bone is not too sclerotic. Similar principles should be used as described above. The curette is also useful to contour the edge of the cartilage defect; an effort should be made to leave the edges of the articular cartilage perpendicular to the subchondral bone.



A motorized shaver can be used for abrasion arthroplasty to remove necrotic cartilage and bone.

Microfracture

To perform microfracture, insert an appropriately angled micropick into the joint and press the tip against the subchondral bone surface. Have an assistant tap the pick handle once or twice. The pick should be held securely to avoid gouging the surface and adjacent healthy cartilage. Apply the micropick diffusely across the diseased area and check for resulting bleeding frequently by stopping inflow of fluid and ensuring adequate outflow. When bleeding is observed diffusely from the lesion bed, lavage the joint to remove the remaining bone debris and close routinely.



Microfracture technique is used to treat the exposed subchondral bone after

Grading primary ED-lesions and elbow osteoarthritis according to the IEWG protocol

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The diagnosis of canine elbow dysplasia (ED) in screening programs is based on the evaluation of radiographs according to the protocol of the International Elbow Working Group (IEWG). The most recent update of this protocol is available on the IEWG web site (<http://www.iewg-vet.org>). A mediolateral flexed projection of each elbow joint is mandatory for interpretation and an additional craniocaudal view is highly recommended. The IEWG protocol registers signs of arthrosis and the presence of the major forms of primary lesions (FCP, OCD, UAP, Incongruity). The films are evaluated in a two-stage process: a) to assess the degree of secondary joint disease (arthrosis) and b) to check for signs of a primary lesion. Any other abnormal finding should also be reported.

The status of the elbow joint regarding arthrosis is scored as either “normal” (Grade 0), mild (Grade 1, osteophytes less than 2 mm high anywhere in the joint), moderate (Grade 2, osteophytes 2 – 5 mm high) and severe (Grade 3, osteophytes higher than 5 mm). In the updated protocol the severity of joint incongruity has been included. The primary lesions have been defined by the IEWG (for details see the IEWG website).

Scoring (updated 2010)

The elbow findings are scored according to the severity of the arthrosis (DJD) and/or the presence of a primary lesion

Elbow Dysplasia Scoring		Radiographic Findings
0	Normal elbow joint	Normal elbow joint, No evidence of incongruency, sclerosis or arthrosis
1	Mild arthrosis	Presence of osteophytes < 2 mm high Suspect sclerosis of the base of the coronoid processes
2	Moderate arthrosis or suspect primary lesion	Presence of osteophytes of 2 - 5 mm high Obvious sclerosis of the base of the coronoid processes Step of 3-5 mm between radius and ulna (suspect INC) Suspect presence of a primary lesion (UAP, FCP, OCD)
3	Severe arthrosis or evident primary lesion	Presence of osteophytes of > 5 mm high Step of > 5 mm between radius and ulna (obvious INC) Obvious presence of a primary lesion (UAP, FCP, OCD)

A Borderline (BL) score between ED 0 and ED 1 is allotted to dogs with minimal anconeal process modelling of undetermined aetiology in some countries.

How many projections?

The minimal requirement is a true ML projection of each elbow. Excessive pronation or supination should be avoided. In a maximally flexed position (as it is the standard view in many countries) the elbow is usually markedly supinated, making correct interpretation of sclerosis and spur formation cranially difficult.

An OC defect may easily be missed on the ML projection, but can usually be identified on a Cr Cd 15° pronated view. As scrutineers in many European countries (Scandinavia, UK) ask only for a maximally flexed ML view of the elbows, an OC lesion may not be recognized.

For many years a Cr15L-CdMO pronated view was considered mandatory for the diagnosis of FCP. However recent results of CT examinations and arthroscopy indicate that radiological findings typical for the presence of FCP can be identified on the ML view quite consistently. The ML projection may therefore be sufficient to diagnose or suspect the presence of a FCP reliably in a screening program.

How to score ED?

ED scoring on the basis of a combination of the severity of arthrosis (DJD) and suspicion or evidence of a primary lesion is not uniformly used in Europe and overseas. The Scandinavian countries for example started scoring in the early 80ies prior to the foundation of IEWG. Their classification is based on the degree of arthrosis, while of the primary lesions only UAP is recorded. This scoring system is used in Scandinavia and also in the UK and USA/Canada.

The most common primary elbow lesion is a FCP. Pertinent radiological findings on the ML projection are a blurred and deformed cranial edge of the medial coronoid process (MCP), a reduced opacity of its tip, an increased opacity of the ulnar notch at the level of the coronoid processes and an increased and/or incongruent joint space between humerus and radius. It is important to recognize that even minimal changes are usually pathognomonic for FCP qualifying an elbow for at least an ED grade 2 (moderate ED, suspicion of FCP) according to the current IEWG protocol regardless of the height of osteophytic new bone formation. The severity of new bone formation is quite variable and some dogs may not show any new bone formation at all. If grading is based on the size of the osteophytes only, many elbows with FCP will be underscored and may even be considered free of ED.

Beware of conflicting data

As mentioned above the IEWG scoring system is a two-step procedure, a) assessing the degree of arthrosis and b) registering any signs indicative of a primary form of ED. Bear in mind that various countries in Europe and overseas only rely on step a). Both concepts have proven to be useful in reducing ED in a population. However problems arise when dogs are to be used for breeding in countries with differing scoring system. In such a case it is advised to re-score the dog again according to the local scoring mode. It will be the aim of IEWG to harmonize the scoring systems in the future.

Slice imaging and appeal procedure

Diagnosing FCP radiographically may be based on subtle findings which may be difficult to convey to the dog owner. As a consequence an increasing number of appeals are filed and owners ask for a CT study to be included in the re-evaluation process. No standardized protocol for CT examination of the canine elbow have been proposed. IEWG plans to install a standardised protocol for appeal procedures, the use of CT and/or MRI examinations and the technical requirements of such studies.

FREE COMMUNICATIONS

Elbow incongruency measurements with X-ray and correction by plated proximal ulna-osteotomie: clinical experience in 46 dogs.

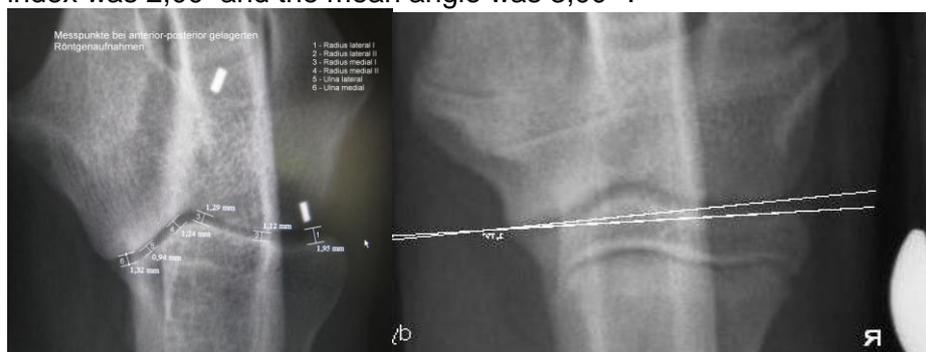
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Radiological Method

Incongruency measurements with radiology are at the moment not possible with the normal a.p. or the m.l. views. As the Coronoid process breaks only when he is loaded, we developed a method to measure incongruency in a standardized way: The limb of anaesthetized dog is in a line, the paw hyperextended and straight, a pressure is put on the olecranon and triceps tendon. The central beam is right into the joint. The distance of subchondral bone from humerus to radius or Ulna is taken at 6 defined measure points (MP1-6) from lateral to medial. Measurements are taken with a digital X ray system (Easy vet) with a magnification of 500%. MP 1 was termed 100 % and MP 2- 6 as relative values to MP1. The lateral distance at MP1 was then divided through the distance of MP 6 and the result named **loading index**. Additionally an angle was taken: the angle point was the contact point of the most medial coronoid process to the most medial and distal subchondral bone of the medial epicondyl, one line was taken from this point to the lateral epicondyle as a subchondral tangent and the other line to the most lateral, visible, subchondral radial jointsurface. We found significant differences to not loaded views. Normal values were evaluated by 50 sound dogs. In the 50 sound dogs the mean loading index was 2,00 and the mean angle was 3,00 °.



Pict: 1-2: 1.) from left to right Mp 1 – Mp 6. 2.) The angle measurements

149 dogs with an FCP were examined in the same way. There were 3 statistically significant groups and one undefined. ($p < 0,05$)

Preliminary Results

- 1.) Short ulna : with a loading index ≥ 4 , and the angle ≥ 4 . **28,86% (n=43)**
- 2.) Short radius : with a loading index < 2 and the angle < 2 . **11,41 (n=17)**

- 3.) Short oblique radius: with a loading index < 2 and the angle ≤ 2 and at (Measurepoint 3 $>$ than measurepoint 3 in the normal view). **18,12% (n = 27)**
- 4.) Group no detectable incongruency . **41,6% (n =62)**

In a cadaver study where ulna was shortend or lengthend in a two dimensional way with an external fixateur and then taken x-rays, we could not find compare able data. Only tilting, shortening and torsioning the ulna in a three dimensional way showed compare able data to the dogs with a short Ulnasyndrom. In the radius a two dimensional shortening showed compare able data.



Pict.1-6: upper row shows from left to right not loaded x-ray:1.) short Ulna 2.) normal elbow 3.) short radius. In the second row the same elbow in a loaded view: 4.) short ulna 5.) normal elbow 6.) short radius.

Surgical correction for short ulna

(Dogs with short radius were treated with the sliding osteotomie on the radius presented on ESVOT 2004 Proceedings (B.Slocum, I Pfeil)

Planing

For surgical correction the standard views are taken, then a line is drawn from the center of the proximal olecranon through the highest and medial elevated point of radius to the distal ulna. The difference of the measured angle to the normal angle is taken and brought to the most medially elevated point of radius and signed distally in the ulna bone in the X-ray. 3.5 cm – 4.5 cm below the joint, there is measured where the distance between the angle is 2 or 3 or 4 mm wide and this determines the osteotomie line for ulna.

Surgery for short ulna syndrome

After arthroscopy of the elbow with removal of all loose fragments the dogs are positioned in dorsal recumbency, the paw is fixed cranial so that the back side of the ulna can be reached. **The paw is not hyperextended but slightly flexed**, the distance for osteotomie is determined by palpating the lateral Radius head and taken from him the distance distally at the ulna. After a caudal approach, the ulna is there osteotomied in an right angle. Mostly the ulna creates at once a small gap as tension is relieved and the proximal bone is going towards the elbow joint, driven from the capillary forces of the joint. Then the Kyon ulna plate with a step of 2, 3 or 4 mm according to the previous measurement, is fixed with two bone clamps one at the proximal and one at the distal ulna bone. Two cortical screws at each side are inserted and then the locking screws. Woundclosure, bandaging after surgery are done, NSAID for 14 -30 days are administered.

The dogs showed after surgery a severe middlegrad lameness up to 8 – 10 weeks post op. As there is a gap always a delayed healing was seen and the osteotomie creates pain up to the 12 week. Mostly the joint creates less pain from the 6 week on. Bone healing was controlled by x-ray and after bone healing the dogs get a course of prednisolon 0,1 mg / kg for 30 – 45 days.



Picture 1-6: German shepherd, male, 10 years. From left to right: 1.)pre-op: a.p.view / not loaded 2.)pre op x-ray with medial narrow joint spac /loaded view. 3). a.p. view post op: medial joint space is wider /loaded view 4.)post op med. lat. view: small gap 5.)arthroscopic findings: whole cartilage erosion on Ulna 6.) medial humerus epicondyle: whole cartilage erosion and subchondral bone erosion.

Results

46 dogs were done with this surgery. Only dogs were chosen with a short Ulna syndrome, where the cartilage at the ulna was higher degraded or eburnated. 38 dogs were done with this surgery with bending ALPS 10 or ALPS 8 plate. Which is technically difficult to make it precise. 8 dogs were done with the new Kyon Ulna step plate. After a time of 16 weeks 87% of the dogs showed a good improvement of lameness, with no need for NSAID anymore as they had before surgery, they were lame free or showed only a grade one lameness (grade 1 – 6) mostly when they were standing up after a resting period .

Complications were seen in 6 dogs: 1 was not corrected enough, in 5 dogs we overcorrected them and in 4 of this dogs cycling and breakage happened to the plate. 3 plates were taken out changing it into a dynamic Ulnaosteotomie two of them improving and one worsening, one dog was double plated and get healed with good result. One dog of the overcorrected dogs had problems with impinging osteophytes at the anconeal process. No complications were seen with the new Kyon ulna step plates which made the surgery much more easier.

Conclusion

Radiological measurements for incongruity is possible in 58,4 % of cases of FCP with significant differences under a loaded and standardiced views. There were seen **short Ulna** and **short radius** as a cause for the FCP. The hypothesis of an 3 dimensional movement of the ulna with the short ulna syndrome and the successfully clinical 3 dimensional surgical correction and improvement of 87 % of the dogs is a hint that this hypothesis might be right. Still more than 41,6 % of the cases remain not detectable and require further studies for loaded standardiced incongruity imaging and improving the method.

Compartmental Bone Induction Stimulus (COBIS) in the treatment of early osteochondral disease

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Kleintierpraxis Kugeliloo Zürich, Switzerland.

Early osteochondral disease in the elbow: subchondral fissures in the medial coronoid process can cause significant lameness and may precede coronoid fragmentation or necrosis.

Early osteochondral disease in the shoulder: subchondral bone fissuring may prevent cartilage replacement by bone during the growth of the humeral head, thus leading to a thickened chondral area, which may then dissectate.

Preliminary hypothesis: Initial microfissuring may not induce a sufficient healing response for the stabilisation of subchondral bone, essential for cartilage health.

Therapeutic hypothesis of COBIS (compartmental bone induction stimulus)

In nonfragmented coronoid or osteochondral disease a harmless additional minimal trauma to the same bone compartment **in an easily accessible extraarticular area** should significantly increase local bone remodelling in the entire compartment (Induction), which in the best case will allow the fissured subchondral bone to heal, potentially avoiding actual fragmentation and subsequent arthrosis.

Induction = several thousandfold activation of osteoblasts and bone remodelling by a fracture or trauma. Fracture healing time without induction would be 200 – 1000 years. (Theoretical calculation, Frost Clin. orthop. 248: 283, 1989) Time limit: Experimentally no additional induction effect has been shown if trauma is repeated after just one week.

Clinical example of bone induction effect: Stimulation of bone with fresh trauma can reactivate the healing process in a “dormant” atrophic nonunion.

Case presentation: A 3 year old miniature poodle with a longstanding femoral fracture, operated three times resulted in an atrophic non-union. The stimulation of bone remodelling with new* external fixateur pins reactivated the bone healing response and lead to healing of the atrophic nonunion due to reactivated bone remodelling only. The owner would not allow further surgery (Fig 1)

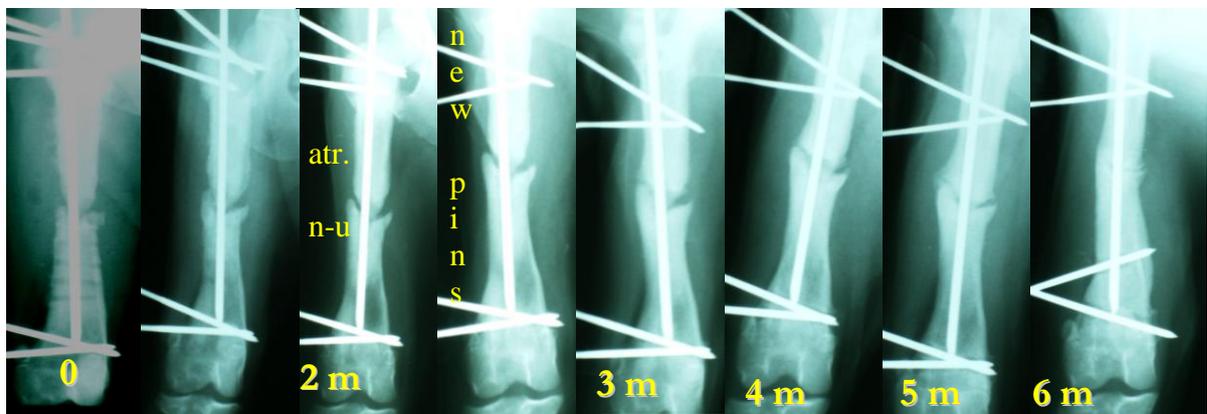


Fig. 1. After several revisions of a fracture an atrophic non-union develops. The dormant bone healing in this atrophic nonunion is reactivated by pin hole trauma only! = Induction effect of pin placement leads to bone healing.

Therapeutic dilemma in early coronoid disease:

What to do in young dogs with elbow lameness and mild radiographic signs, without direct clinical signs of synovitis or fragmentation? (elbow not directly painful) (Fig.2)

In nondisplaced non-fragmented coronoid disease, where the cartilage is mildly malacic preserving this cartilage might delay arthrosis progression in selected cases. The problem of the lameness however is not resolved. With COBIS the lameness may be positively affected in addition to improving subchondral bone health. At best fragmentation might be avoided.

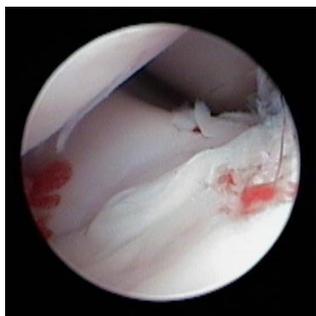


Fig.2. Right elbow: Obvious coronoid disease. This case will be treated by debridement by all surgeons. Arthrosis is an inevitable sequel.



Left elbow: Subchondral coronoid disease. A potential candidate for COBIS treatment. The development of arthrosis may be delayed or prevented if the cartilage can be preserved and subchondral fissures might heal.

Controversy in the treatment of osteochondral disease

Revised rationale for arthroscopy in coronoid disease after 14 years of arthroscopy:

True indications for elbow arthroscopy in coronoid disease	Relative contraindications for elbow arthroscopy:
<ul style="list-style-type: none"> -diagnostics -the hope to achieve pain relief by debridement -the hope to prevent severe kissing lesions 	<ul style="list-style-type: none"> -lame-free dogs despite radiographic signs -moderately lame dogs with no direct elbow pain and mild radiographic signs

Actual fragmentation of the cartilage of the medial coronoid process initiates the development of arthrosis (osteoarthritis) regardless of subsequent treatment. Cartilage fragmentation often follows prior subchondral bone disease with microfissuring. Not all cases of fissuring progress to fragmentation of the medial coronoid process. Cartilage health depends on healthy subchondral bone.

Synovitis and arthrosis usually develop after actual osteochondral fragmentation*. Arthroscopic debridement of the medial coronoid process does not prevent arthrosis. Removing cartilage and bone in nonfragmented coronoid disease may even accelerate the development of arthrosis in cases where the cartilage was still intact, albeit not healthy*

Preserving mildly diseased cartilage may delay the development of severe arthrosis and the onset of medial compartment syndrome by months.

Aggressive arthroscopic debridement may accelerate the development of arthrosis.

In a recent study a coronoid fissure detected by computer tomography was confirmed arthroscopically in only 15 of 29 cases once again confirming the subchondral nature of the initial disease (Diagnostic value of CT and MRI for the diagnosis of coronoid pathology in the dog. Klumpp et.al, Tierärztl. Praxis 2010; 38 (K): 7-14)

Technique of Compartmental Bone Induction Stimulus (COBIS) (Fig 3):

A mildly invasive, harmless and virtually nonpainful technique, COBIS is the percutaneous application of one or two 1.6 mm pin holes to the afflicted bone compartment in an easily accessible location. Activity restriction to prevent fragmentation is recommended for 6 weeks, in which time the COBIS effect should have taken place.

ELBOW COBIS: pin hole trauma to Olecranon (1–2 x 1.6 mm)
SHOULDER COBIS: pin hole Trauma to tuberculum majus (1–2 x 1.6 mm)



Fig 3. COBIS: percutaneous pin hole to subcutaneous bone within affected compartment

Therapeutic hypothesis of COBIS (compartmental bone induction stimulus)

In nonfragmented coronoid or osteochondral disease a harmless additional minimal trauma to the same bone compartment **in an easily accessible extraarticular area** should significantly increase local bone remodelling in the entire compartment (Induction), which in the best case will allow the fissured subchondral bone to heal, potentially avoiding actual fragmentation and subsequent arthrosis.

Clinical effect: in some dogs lameness is resolved temporarily or definitively! In the best case arthroscopy or surgery can be avoided. The technique is harmless! If clinical success is not evident within weeks, arthroscopy can still be performed later.

Ideal moment for compartmental bone induction stimulus (COBIS):

1. At initial exam: Since COBIS can positively affect the lameness it seems worth a try, potentially even before resorting to arthroscopy. If a dog is sedated for radiography it is a small effort to apply COBIS in the same sedation.

2. At arthroscopy: In cases that go to arthroscopy and where the cartilage is arthroscopically still intact, COBIS can also be applied instead of debridement of the intact looking coronoid process or humeral head, since COBIS does not initiate the development of arthrosis. Debridement can always be done at a later date if necessary.

Case presentations of COBIS

Case presentation 1. (Phoenix 363, one year old Labrador):

Severe subchondral sclerosis without arthrosis of the right elbow: healing fissures? No direct pain elicited! MRT is suggestive of fragmented coronoid process. (Fig 4)

Problem: Arthrosis is **guaranteed** to develop after coronoid removal. The experienced owner refused arthroscopy despite positive MRT, so as to avoid the development of arthrosis.

**Compartmental bone induction stimulus (COBIS) resolved the lameness permanently within four weeks!
On 2 month followup radiography arthrosis did not develop. The lameness did not recur. (2 yr FU)**



Fig. 4. subchondral sclerosis

Case presentation 2. (Patch 5638, 5 month old Labrador) Mild lameness with no direct pain. At 8 months, no lameness, but significant subchondral sclerosis of left elbow and direct pain on medial palpation of elbow. COBIS > no negative clinical effect. In followup radiographs after 1 year the subchondral sclerosis has diminished significantly! (Fig 5) Possible prevention of fragmentation?

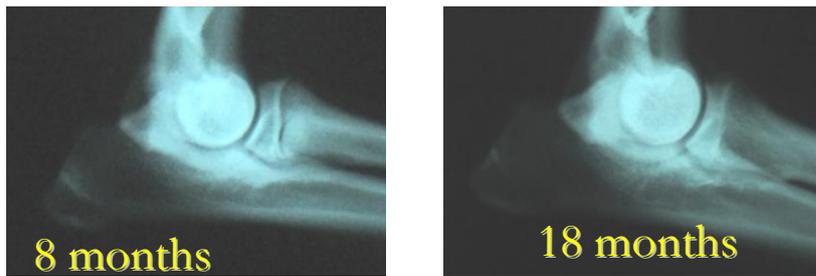


Fig. 5: The subchondral sclerosis at 8 months (left) was treated with COBIS. The sclerosis has disappeared as documented at 18 months (right).

Case presentation 3. Exotic use of COBIS technique: (Finley 7862, 9 month old german shepherd) 3 week lameness with variable response to Rimadyl. Radiographic diagnosis **Panostitis** of left Ulna.

COBIS treatment > resolution of pain within one day.

Panostitis of right Ulna two months later > COBIS treatment > resolution of lameness. –

Discussion: This effect can not be explained by bone induction, but could possibly be related to a change of blood flow after the pin hole trauma.

Case presentation 4. (Nala 8009, 7 month old Shepherdmix) elbow lameness of 2 month duration, mild radiographic sign at anconeus. > COBIS bilaterally > resolution of lameness . Followup radiographs no progression on left side, mild progression of arthrosis on right side. Radiographs unfortunately no longer available.

Case presentation 5. Shoulder OCD: (NICA 5 month old Flat coated retriever) presented for right shoulder lameness. Incidental finding of obvious radiographic sign of Osteochondrosis in left shoulder, possibly not dissected. Bone regeneration within lesion visible 4 weeks after COBIS. Resolution of OCD documented after 14 weeks. (Fig. 6)

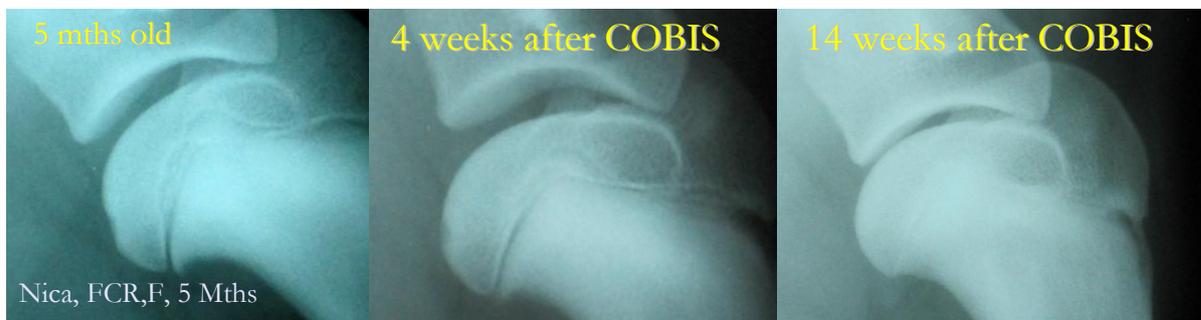


Fig.6: Visible effect of COBIS in shoulder osteochondrosis? (possibly not dissected)

Case presentation 6. Shoulder OCD: (ChaChaCha,, 6 month old king poodle) bilateral shoulder OCD. Example left shoulder. After COBIS treatment obvious regeneration of new bone within lesion at 3 weeks. (Fig 7) The lameness seems much better. However, over the next weeks of leash restraint the variable lameness persists. After 13 weeks the osteochondrosis is not resolved or has recurred. At bilateral arthroscopy osteochondral flaps are removed. The subchondral bone is quite solid. Both owner and veterinarian are frustrated over time loss. Conclusion: Arthroscopy was unduly delayed.

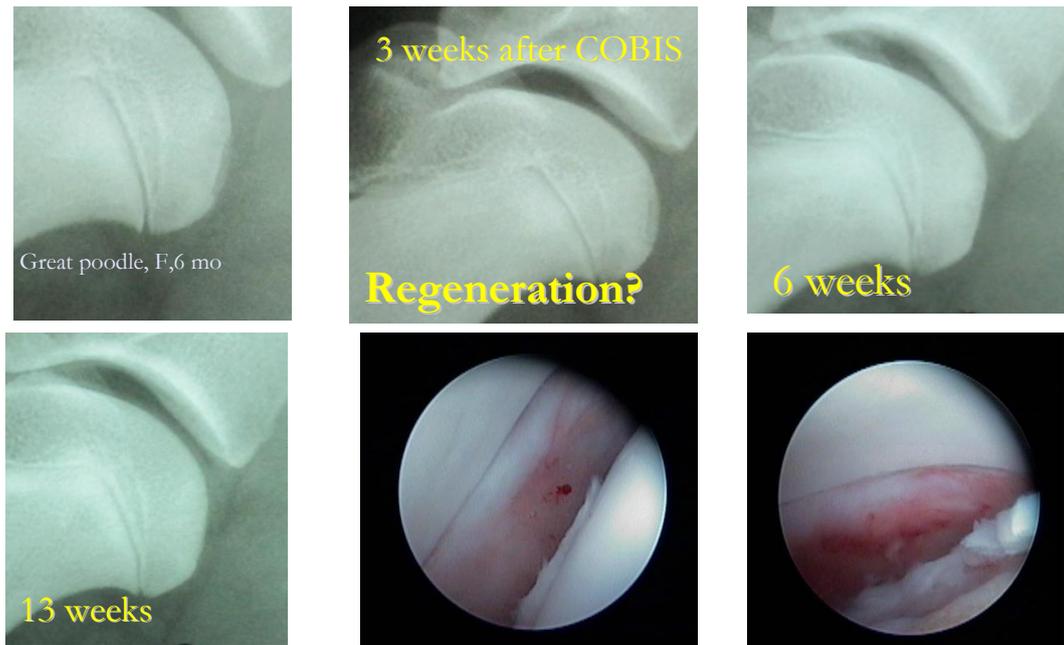


Fig.7: After initial regeneration response at 3 weeks, a recurrence of the OCD or stagnation of the regeneration effect is suspected at 6 weeks and confirmed after 13 weeks. The lameness recurred. On arthroscopy an OCD flap is removed. The subchondral bone is solid. Conclusion: Arthroscopy was unnecessarily delayed and the dog (and owner) had to unnecessarily suffer activity restriction for an extended period.

Case presentation 7. Shoulder OCD with unilateral COBIS at arthroscopy: (Fuego, 8334, 6 month old great swiss mountain dog) bilateral shoulder OCD. Bilateral arthroscopy. Debridement of OCD flap on right. No flap on left > COBIS. Comparison of progress 4 weeks after treatment (Fig 8)

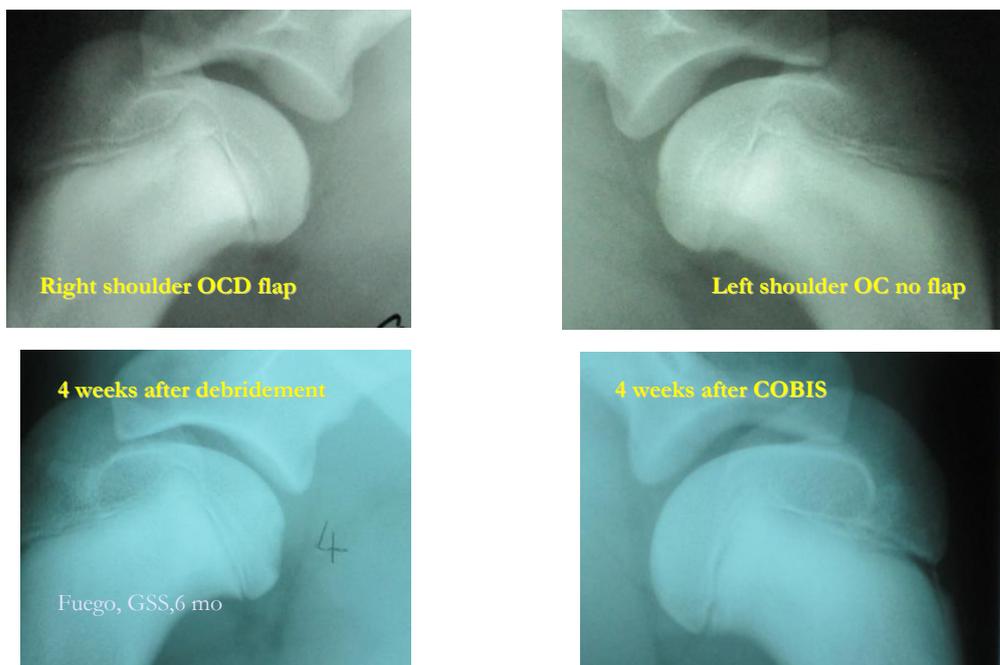


Fig. 8. Arthroscopic treatment of OCD-flap in the right shoulder with curettage defect still visible 4 weeks after treatment. COBIS treatment in left shoulder after arthroscopically confirmed intactness of cartilage. After 4 weeks the resolution of the radiographic OCD lesion in the left shoulder is evident. Is this due to COBIS

treatment or is this natural healing? COBIS may have played a positive role, it certainly has not had a negative effect.

Case 8: COBIS repeated after one year. (Carina 7829, 7 Month old Labrador retriever)
At 7 Months left unilateral triple pelvic osteotomy and simultaneous COBIS treatment left elbow for subchondral sclerosis. Mild lameness in left forelimb one year later with minimal radiographic elbow changes was resolved with COBIS treatment.

Unsuccessful cases:

The “failure” scenario as described in case 7. was encountered in several cases of elbow and shoulder disease where arthroscopy became necessary 4-8 weeks after COBIS treatment and was explained by progression to fragmentation possibly due to insufficient activity restriction. Here a selection of cases:

Case 9: A 6 month Border collie with mild shoulder OCD was excellent for 5 weeks and suddenly became lame after increased activity. On arthroscopy a medial flap had dissected.

Case 10: A 11 month Labrador retriever with subchondral sclerosis in the elbow. Variable response to COBIS. Acute fragmentation after 2 months.

Case 11: A 6 month Golden retriever with moderate sized shoulder OCD. No response to COBIS treatment. At arthroscopy bilateral flaps were removed.

Discussion of COBIS:

The possibility of stimulating bone regeneration by such a minimal treatment seems evident with the documented cases. The theoretical concept of COBIS is supported by these few presented cases where bony deficits change radiographically after treatment. In the shoulder early OCD healing could be shown. Whether this is due to COBIS treatment is however not yet proven. We have not documented untreated natural case progression in the same time frame. In the elbow clinical efficacy of COBIS over medical treatment was shown in one case (1) where a longstanding lameness disappeared permanently. At present however there is no scientific proof that this treatment works, nor is there scientific proof that the treatment mechanism is as hypothesized.

In the elbow documentation by CT scans with followup would be helpful, however for obvious reasons lies beyond the financial range of private practice. Histological evidence of the treatment effect would be better, however can not be done with patients. Furthermore it must be pointed out that the comparison to natural disease progression or healing has not yet been made.

An interesting consideration is that with ulnar osteotomies (high or low) bone remodelling is stimulated as with any fracture. Bone induction is a side effect with potential benefit in nonfragmented coronoid disease. Maybe the actual osteotomy is overkill, apart from being painful if placed proximally.

Nevertheless, the present study is highly suggestive that a minimal and harmless COBIS treatment can at best possibly prevent fragmentation and subsequent arthrosis development in early osteochondral disease, which in itself is sufficient reason to pursue this concept, especially in the elbow. Therefore COBIS treatment is worth further critical study.

Advantages of COBIS treatment (compartmental bone induction stimulus)

1 – 2 pinholes (1.4 – 1.6 mm in Olecranon or Tuberculum majus humeri)

- Easy to apply simultaneously with arthroscopy
- Expected to be non painful for patient postoperatively
- Also applicable without arthroscopy
- Potential benefit for all remodelling processes
- Extraarticular procedure not involving the subchondral bone directly

- Does not cause arthrosis

•

Disadvantages of COBIS

- Time loss in treatment possible
- Treatment efficacy not guaranteed
- Extra cost for followup radiographs
- Slightly prolonged activity restriction in young patient
- Inappropriate use due to lack of understanding quite possible

Therapeutic conclusion: In non-displaced & non-fragmented coronoid disease with mild chondromalacia, arthrosis progression may be delayed by preserving cartilage and by stimulating subchondral bone healing. **COBIS treatment is worth a try in selected early cases.**

Correspondance: kramers@bluewin.ch Keyword COBIS

Osteoarthritis treatment in dogs

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University of Turin, Italy.

Introduction

Osteoarthritis (OA) is a syndrome that affects synovial or diarthrodial joints, causing pain and degeneration of articular cartilage along with changes in periarticular soft tissues. Osteoarthritis is present in between 8 and 20% of dogs, making it the most common articular condition in this species¹.

OA can be primary or secondary. Since primary OA is rare in the dog, it is most commonly secondary to a primary problem, like hip or elbow dysplasia, osteochondrosis, growth deformities, ligament injuries, articular fractures.

Diagnosis of OA

OA is a continuous disease process, although the clinical pattern is characterized by periods of apparently few clinical signs followed by intermittent acute episodes of pain. The classical clinical signs are: exercise difficulty, stiffness, lameness, reduced range of motion, muscle atrophy, crepitus, swollen joints.

In veterinary orthopedics, plain radiography is the imaging technique of choice, routinely used for diagnosing joint abnormalities. Specific changes in the appearance of the osteoarthritic joints include: narrowing of the joint space, increased density of the subchondral bone, new bone formation at the joint margins, proliferative and lytic changes at the attachment site of the joint capsule and ligaments^{2,3}. The radiographic study could be integrated by synovial fluid analysis to exclude the possibility of sepsis or immune mediated arthropathy.

Arthrography is seldom used in small animal orthopedics: is a simple technique and, for example, arthrograms can roughly visualize the extent of the joint capsule and the synovial surface outline in the shoulder joint.

CT scanning enables a more detailed and specific morphological diagnosis than radiography and greatly facilitates examining complex joint structures such as the elbow and tarsus. New bone formation and lysis are better identified on CT images.

Treatment of OA

Dietary restriction to prevent or to treat overweight, planned exercise and physiotherapy to maintain range of motion of the affected joint are always recommended. Recent studies seem to support that the integration of the animal's diet with fatty acids of the omega-3 series improves the patient's mobility.

Pharmacological treatment revolves mostly around the use of NSAIDs, aided by nutraceuticals such as glucosamine and chondroitin sulphate. NSAIDs inhibit the cyclooxygenase enzyme (COX-2) and lipoxygenase pathways, which are the key components in the cycle of inflammation. NSAIDs have been developed for this purpose but generally do not all selectively block mainly the COX-2 pathway.

Several NSAIDs have been recently approved for the use in dogs. These are considered to have a low COX1:COX2 ratio, but have toxicity potential as with any other NSAIDs. Hepatic toxicosis had been reported with long-term therapy⁴.

Based on whole blood canine assays carprofen, deracoxib, meloxicam and nimesulide may be classified as preferential or selective NSAIDs, whilst firocoxib, robenacoxib and mavacoxib have specific activity against COX-2.

Surgical treatment is recommended when a correction of the primary joint disease causing secondary OA is possible. For example, Total Hip Replacement (THR) could be an option for hip dysplasia treatment. In the stifle affected by OA secondary to CCL rupture stabilization of the joint with a corrective osteotomy or extracapsular suture may be necessary.

Post-operative acute pain in OA patients can be successfully managed with a selective COX-2 NSAIDs administered for 5-12 days. In old patients, it is recommended the use of gastro-protective drugs to prevent gastrointestinal side effects.

Treatment in patients in which surgery is not feasible, is focused on chronic pain management. In these cases, prolonged therapy (more than 3 weeks) are required and COX-2 specific inhibitors are selected. Chronic patients in the acute phase, where clinical signs are apparent, can be successfully converted to a clinically silent phase with intra-articular lavage followed by intra-articular injections of hyaluronic acid and NSAIDs oral administration. The recent introduction of a new group of long acting formulations (mavacoxib) has increased owners compliance through simplified patient management in the treatment of chronic patients with severe OA. Blood exams are routinely recommended before the beginning of the pharmacological treatment.

References

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2. Aragon CL. JAVMA 2007; 230 (4): 514-521;
3. Carrig CB. Vet Clin North Am Small Anim Pract. 1997; 27: 777-814;
4. Bjorkman D. Am J Med 1998; 105:17S-21S;

Animal

Pedigree name _____
 Breed _____
 Registration nr _____ Tattoo _____
 Microchip nr _____
 Date of birth day month year Sex F (female intact) Fs (female spayed)
 M (male intact) Mc (male castrated)

Owner

Name _____
 Address _____
 Country, Zip Town

The undersigned agrees to the 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 of the examination will be registered and archived as designated by the national Kennel Club, and are made available for official publication.

Signature owner / handler _____

Veterinarian

Name _____
 Address _____
 Country, Zip Town

Identification of the dog

Check tattoo Correct Incorrect Absent Partly /unreadable
 Check microchip Correct Incorrect Absent New tattoo chip number _____

Radiographic views

Date radiographic examination day month year Age Years Months
 Radiographic projections Medio-lateral-45° Cranio-caudal-15°proned
 Medio-lateral-90° Cranio-caudal
 Medio-lateral >120° Other: specify _____

Stamp / personalia veterinarian _____

The undersigned agrees that the examination was performed according to the valid IEWG protocol. Furthermore the undersigned states that the identity of the above mentioned dog has been verified. The results of the examination will be registered and archived by the national Kennel Club

Signature veterinarian _____

Results of the evaluation by the national ED-panel

Evaluation panel

Name _____
 Address _____
 Country, Zip Town

Radiographic evaluation

Date evaluated day month year

Primary lesions	NONE		UAP		FMCP		OC		Inc		OTHER		Affected
	R	L	R	L	R	L	R	L	R	L	R	L	
	<input type="checkbox"/>												
	<input type="checkbox"/>	Suspected											

Secondary arthrosis	Grade
<input type="checkbox"/>	Grade 0
<input type="checkbox"/>	Borderline
<input type="checkbox"/>	Grade I
<input type="checkbox"/>	Grade II
<input type="checkbox"/>	Grade III

Arthrosis score according to the IEWG protocols

Stamp / personalia evaluation panel _____

The undersigned agrees that the radiographic evaluation was performed according to the valid IEWG protocol.

Signature representative evaluation panel _____

Interpretation

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

Primary Lesions
 UAP: Ununited Anconeal Process
 FMCP: Fragmented Medial Coronoid Process
 OC: Osteochondrosis or Osteochondritic dissecans of the medial humeral condyle
 INC: Incongruity 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 recommend breeding of arthritic animals or animals displaying a primary lesion.

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	Jeruzalem [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
2010	Bologna

IEWG 2010

president	Herman Hazewinkel	H.A.W.Hazewinkel@uu.nl
treasurer	Bernd Tellhelm	Bernd.Tellhelm@vetmed.uni-giessen.de
secretary	Thijs How	How@wxs.nl

website: **www.iewg-vet.org**