General Biomechanical Considerations

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Why so Predominantly Medial and Medial Only?

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Best bet for good elbows?
RIGHT LEG (on all images)
LATERAL ASPECT

CAUDAL

CRANIAL

$F_T$

$F_{HU}$

$F_J$

$F_{HR}$

$F_G$

com tan

hum-rad
RIGHT LEG MEDIAL ASPECT

CRANIAL

CAUDAL
RIGHT LEG CAUDAL ASPECT

\[\Delta\]

\(F_{MC}\)

\(M_{FG}\)

\(F_{LCLL}\)

\(F_{G}\)

\(MED\)

\(LAT\)
Elbow Incongruency
Correcting Osteotomies

- distal ulna ostectomy
- proximal ulna oblique osteotomy
- proximal radius oblique / lengthening osteotomy

... all, incidentally, effect the paw, hence loading of the elbow
Humeral Sliding Osteotomy

- Effect of humeral osteotomy on joint surface contact in canine elbow joints.

- In vitro force mapping of normal canine humeroradial and humeroulnar joints.
Humeral Sliding Osteotomy


HUMERAL SLIDING (SCHULZ) OSTEOTOMY

CRANIAL ASPECT

EFFECT OF GAIT ADJUSTMENT (?)
HUMERAL SLIDING (SCHULZ) OSTEOOTMY

EFFECT OF GAIT ADJUSTMENT

PLUS ACCIDENTAL ANGULATION
Humeral Sliding Osteotomy

... ameliorates lameness and pain ... at medium-term follow-up. Application technique is critical to minimizing morbidity.

Proximal Ulnar Osteotomy with Plate Fixation (Pfeil)

- proposed by Ingo Pfeil
- 5 years of clinical application; the last 2 years with special ALPS plates (3 versions)
- ~ 70 cases by I. Pfeil; ~ 200 in total by ~ 30 surgeons

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ULNAR PROXIMAL (PFEIL) OSTEOTOMY

LATERAL ASPECT

CAUDAL

CRANIAL

\( F_T \)

\( F_J \)

\( F_G \)
ULNAR PROXIMAL (PFEIL) OSTEOTOMY

CAUDAL ASPECT

MED
In Vitro Demonstration

- Andreas Gutbrod, Tomas Guerrero
- normal front limb loaded by a weight in a vertical compression frame before and after osteotomy
- 3mm step/6 deg angulation plate
- pressure sensors within transverse slits cut in the bones subchondrally

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In Vitro Demonstration

intact with osteotomy
Effects

- ulna angulated (plate + bone curvature) - paw lateraled (+)
- distal ulna internally rotated (bone twist) - paw externally rotated (+)
- transverse step at osteotomy (?)
- opening gap at osteotomy (?)

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Implants

- special ALPS plates
- size 10 (screws: locking B4.0; cortical 2.7)
- size 8, *new* (locking B3.2; cortical 2.4)
- sizes 9 and 11 by spring of 2012
- Ti alloy, fixed geometry, type II anodization
- no implant failures (0/200)
- choice of steps reduced to 2

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How about:

HUMERAL (EXTERNAL) ROTATION OSTEOTOMY?
HUMERAL (EXTERNAL) ROTATION OSTEOTOMY

MEDIAL ASPECT

CRANIAL

CAUDAL

$F_T$

$F_J$

$F_G$
In Vitro Demonstration

- Andreas Gutbrod, Tomas Guerrero
- 8 normal front limbs loaded by weight in a vertical compression frame before and after osteotomy
- 15 deg rotation at osteotomy
- pressure sensors within transverse slits cut in the bones subchondrally
In Vitro Demonstration

intact

with osteotomy
Clinical Experience – one case
How about:

MEDIAL RADIUS OPENING WEDGE OSTEOTOMY?
Clinical Experience – one case
Caution, gate matters!

- gate analysis-based planning?
- radiography-based planning?
  surrogate, good enough?
Osteotomies for Elbow

- historically, accidentally effective (?)
- palliative (?)
- morbidity (?)
Osteotomies for Elbow

- humerus vs. radius vs. ulna
- self-adjusting vs. fixed
- ill-conditioned healing (sliding, transverse, opening gap ...)
- locking, titanium, special plate
- infection risk with ALPS <1%
ALPS 10 implant ...

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… and instrument set
For ulna osteotomy:

**Implants:**
special plates and screws of different lengths

**Instruments:**
drill guides (locking and neutral)
drills
depth gauge, screwdriver