UPDATE TO EVIDENCED-BASED REHABILITATION TO TREAT ELBOW TRAUMA AND STIFFNESS

April O'Connell, OT/L, CHT, ACSM

DISCLOSURE

I have no financial relationships to disclose within the past 12 months relevant to my presentation.

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LEARNING OBJECTIVES

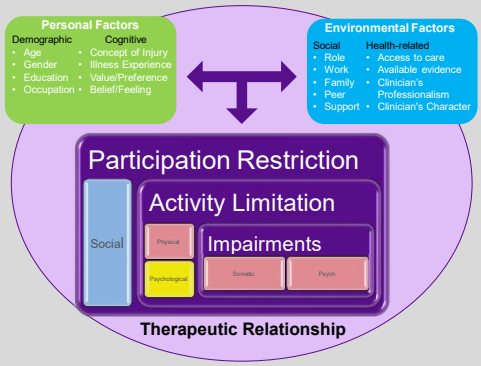
1) **Understand specific areas of how patient occupational performance can be affected by elbow dysfunction.**
2) **Describe normal and functional upper extremity range of motion as it relates to occupational performance.**
3) **Differentiate between latest post-operative rehabilitation protocols for elbow injuries and instabilities.**
4) **Implement and prescribe therapeutic exercise for goals of power, endurance and strength to return to full functional use of affected elbow and it's kinetic chain**
5) **Understand the role of proprioception and joint position sense and how to recover lost proprioception after injury to the elbow**

2011 Levels of Evidence Table

Question	Step 1 (Level 1*)	Step 2 (Level 2*)	Step 3 (Level 3*)	Step 4 (Level 4*)	Step 5 (Level 5)
How common is the problem?	Local and current random sample surveys (or censuses)	Systematic review of surveys that allow matching to local circumstances**	Local non-random sample**	Case-series**	n/a
Is this diagnostic or monitoring test accurate? (Diagnosis)	Systematic review of cross sectional studies with consistently applied reference standard and blinding	Individual cross sectional studies with consistently applied reference standard and blinding	Non-consecutive studies, or studies without consistently applied reference standards**	Case-control studies, or "poor or non-independent reference standard"**	Mechanism-based reasoning
What will happen if we do not add a therapy? (Prognosis)	Systematic review of inception cohort studies	Inception cohort studies	Cohort study or control arm of randomized trial*	Case-series or case-control studies, or poor quality prognostic cohort study**	n/a
Does this intervention help? (Treatment Benefits)	Systematic review of randomized trials or *n*-of-1 trials	Randomized trial or observational study with dramatic effect	Non-randomized controlled cohort/follow-up study**	Case-series, case-control studies, or historically controlled studies**	Mechanism-based reasoning
What are the COMMON harms? (Treatment Harms)	Systematic review of randomized trials, systematic review of nested case-control studies, *n*-of-1 trial with the patient you are raising the question about, or observational study with dramatic effect	Individual randomized trial or (exceptionally) observational study with dramatic effect	Non-randomized controlled cohort/follow-up study (post-marketing surveillance) provided there are sufficient numbers to rule out a common harm. (For long-term harms the duration of follow-up must be sufficient.)**	Case-series, case-control, or historically controlled studies**	Mechanism-based reasoning
What are the RARE harms? (Treatment Harms)	Systematic review of randomized trials or *n*-of-1 trial	Randomized trial or (exceptionally) observational study with dramatic effect			
Is this (early detection) test worthwhile? (Screening)	Systematic review of randomized trials	Randomized trial	Non -randomized controlled cohort/follow-up study**	Case-series, case-control, or historically controlled studies**	Mechanism-based reasoning

- **Clinical Practice Guideline – CPG (e.g. Wong et al, 2017:CPG)**
- **Official/Consensus Statement – (e.g. Easton et al, 2009: AHA Scientific Statement)**
- **Scoping Review – SR (e.g. Keisler & Carter, 2015:SR)**

Integrated Model



OUTLINE

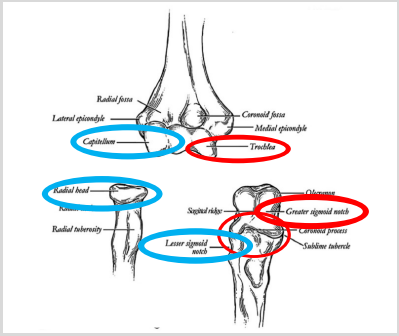
- Section 1: Anatomy
- Section 2: Updated rehabilitation protocols for elbow injuries
- Section 3: Exercise as Medicine
- Section 4: Therapeutic and proprioceptive exercises to gain maximum functional outcomes

APTA 2014

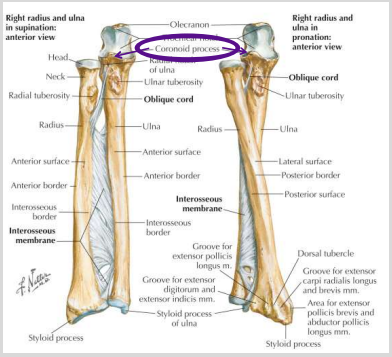
Section 1: Anatomy

- *OSTEOLOGY*
- *MUSCLES*
- *BIOMECHANICS*

Anatomy: *Osteology*



Anatomy: *Osteology*



Permission:
Cleland, Koppenhaver & Su (2016)

Anatomy: *Osteology*

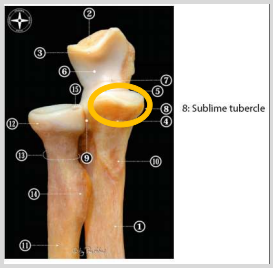


Photo credit: Mark Anderson and *The Radiology Assistant*

Anatomy: *Osteology*

Joint	Type & Classification	Closed Pack Position	Capsular Pattern
Humeroulnar	Synovial: hinge	Elbow extension	Flexion limited more than extension
Humeroradial	Synovial: condyloid	0* of flexion, 5* of supination	Flexion limited more than extension
Proximal radioulnar	Synovial: trochoid	5* of supination	Pronation = supination
Distal radioulnar	Synovial: trochoid	5* of supination	Pronation = supination

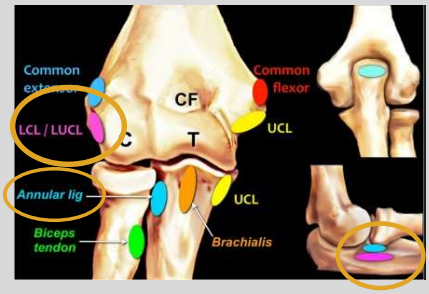
Cleland, Koppenhaver & Su (2016)

Anatomy: *Osteology*

Ligaments	Attachments	Function
Lateral collateral ligament (LUCL, RCL, AL, ACL)	Lateral epicondyle of humerus to annular ligament of radius	Resists varus stress. Stabilizes radial head, resists PLRI
Annular ligament of radius	Coronoid process of ulna, around the radial head to lateral border of radial notch of ulna	Holds head of radius in radial notch of ulna and allows forearm supination and pronation
Ulnar collateral	Medial epicondyle of humerus to coronoid process and olecranon of ulna	Resists valgus stress
Oblique cord	Tuberosity of ulna to just distal to tuberosity of radius	Transfers force from radius to ulna and reinforces proximity of ulna to radius
Interosseous membrance	Lateral border of ulna to medial border of radius	Transfers force from radius to ulna and reinforces proximity of ulna to radius

Cleland, Koppenhaver & Su (2016)

Anatomy: *Ligaments*



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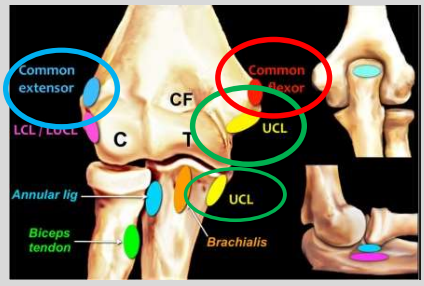
Cleland, Koppenhaver & Su (2016)

Anatomy: *Ligaments*



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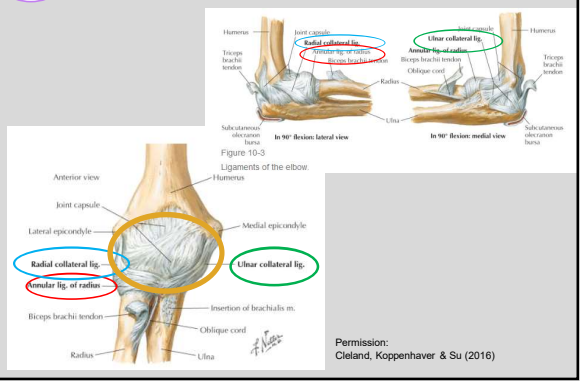

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Anatomy: *Musculature*

Muscle	Proximal Attachment	Distal Attachment	Nerve/Segmental Level	Action
Triceps brachii (long head)	Infraglenoid tubercle of scapula	Olecranon process of ulna	Radial nerve (C6, C7, C8)	Extends elbow
Triceps brachii (lateral head)	Superior to radial groove of humerus			
Triceps brachii (medial head)	Inferior to radial groove of humerus			
Anconeous	Lateral epicondyle of humerus	Superoposterior aspect of ulna	Radial nerve (C7, C8, t1)	Assists in elbow extension, stabilizes the elbow joint

Cleland, Koppenhaver & Su (2016)

Anatomy: *Musculature*

Muscle	Proximal Attachment	Distal Attachment	Nerve/Segmental Level	Action
Biceps brachii (long head)	Supraglenoid tubercle of scapula	Radial tuberosity and fascia of forearm	Musculocutaneous nerve (C5, C6)	Flexes shoulder, flexes elbow
Biceps brachii (short head)	Coronoid process of scapula			Supinates forearm and flexes elbow
Brachialis	Distal aspect of humerus	Coronoid process and tuberosity of ulna	Musculocutaneous nerve (C5, C6)	Flexes elbow

Cleland, Koppenhaver & Su (2016)

Anatomy: *Musculature*

Muscle	Proximal Attachment	Distal Attachment	Nerve/Segmental Level	Action
Flexor Carpi Ulnaris	Medial epicondyle and medial margin on olecranon	Pisiform, hook of hamate, base of 5th metacarpal	Ulnar nerve (C8, T1)	Flexion and ulnar deviation of wrist
Flexor Carpi Radialis	Medial epicondule	Bases of 2nd-3rd metacarpal	Median nerve	Flexion and radial deviation of wrist
Flexor Digitorum Superficialis	Medial epicondyle	Anterior margin on base of middle phalanges of digits 2-5	Median nerve	Flexion of digits at PIPJ
Prontator teres	Medial supracondylar ridge, coronoid process	Middle of the lateral surface of the radius	Median nerve	Pronation of forearm

Cleland, Koppenhaver & Su (2016)

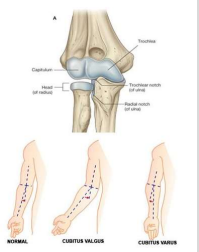
Anatomy: *Musculature*

Muscle	Proximal Attachment	Distal Attachment	Nerve/Segmental Level	Action
Extensor carpi ulnaris	Lateral epicondyle, olecranon, posterior surface of ulna, antebrachial fascia	5th metacarpal	Radial nerve C7, C8	Extended and ulnarly deviates wrist
Extensor digitorum communis	Lateral epicondyle	Extensor expansion of middle and distal phalanges of 2-5th digits	Posterior interosseous nerve	Extension of wrist and MPJs
Extensor carpi radialis brevis	Anterior lateral epicondyle	Posterior base of 3rd metacarpal	Radial nerve	Extends and radially deviates wrist
Extensor carpi radialis longus	Lateral supracondylar ridge	2nd metacarpal	Radial nerve	Extends and radially deviates wrist

Anatomy

The Carrying Angle

- A result of the trochlea extending more distally than the capitulum
- 10°-15° in men
- >15° in women



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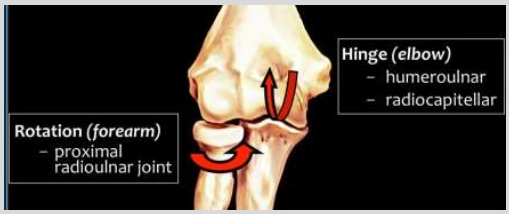
Anatomy: *Biomechanics*



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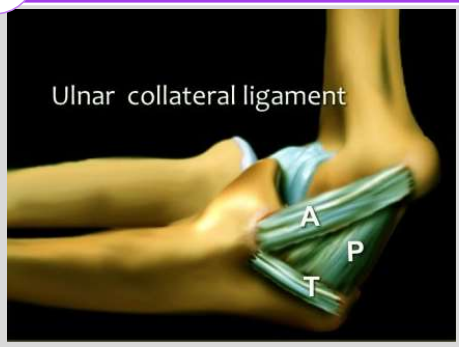
Anatomy: *Biomechanics*



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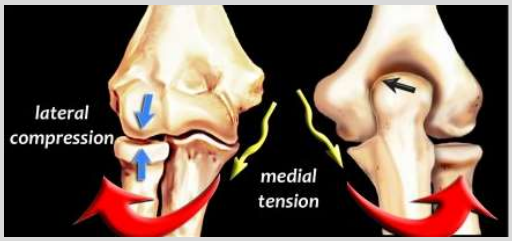

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Anatomy: *Biomechanics*

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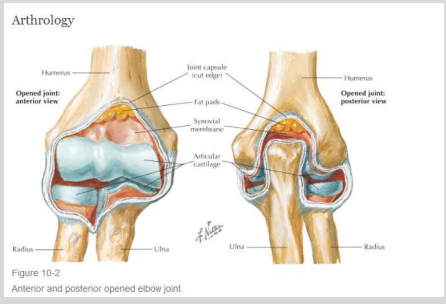

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Anatomy: *Biomechanics*

Anterior capsule

Joint distraction

Joint hyperextension

Valgus Stress

Posterior capsule?

Section 2: Updated rehabilitation protocols for elbow injuries

- ***DIAGNOSIS***
- ***PROGNOSIS***
- ***INTERVENTION***

Diagnosis: Elbow Fractures

Diagnosis: *Radial Head Fractures- Update*

- Inability to flex or extend, supinate or pronate elbow

– Complications:
  - Elbow stiffness (especially in extension)
  - Arthrosis of radiocapitellar joint
  - Nonunion
  - Heterotopic bone

AAOS, 2014

Diagnosis: *Radial Head Fractures*

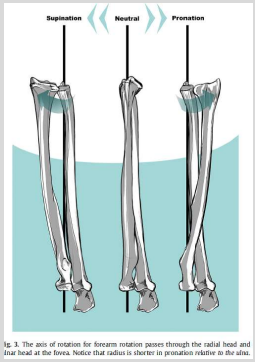


Fig. 3. The axis of rotation for forearm rotation passes through the radial head and ulnar head at the fovea. Notice that radius is shorter in pronation relative to the ulna.

Altman, 2016

Diagnosis: *Radial Head Fractures*

- **Associated ligamentous injuries**
  - **MRI detected 61%-80% (not always clinically relavant)**
  - **LCL injuries 11%; MCL injuries 1.5%; Combined lesion 6%**
- **Associated elbow dislocation with coronoid fracture**
  - **3-14% of radial head fractures**
- **Torn interosseous membrane**
- **Chondral lesions of capitellum**
  - **39-96% MRI indicates injury to the capitellum**
- **Neurovascular injury**

Kodde, I et al, 2015: SR
Kass et al. 2011

Diagnosis: *Radial Head Fractures*

Starting early exercise and mobilization is more beneficial than starting exercise later after delayed mobilization[1]

Cochrane SR found no difference in early vs delayed mobilization of Mason type I and II radial head fractures[2]

1. Bruder, A et al. 2017. SR.
2. Harding P. et al. 2011. SR.

Intervention: *Radial Head Resection*

82% of load received by radius from wrist
18% of load received by ulna from wrist

Normal extremity: Force transmitted from radius by tension in central band of interosseous membrane ➡ ulna ➡ axial skeleton

Status-post resection: Increased reliance on IOM to prevent proximal migration of radius

Yaiza L. et al. 2016

Intervention: *Radial Head Resection*

Therapy Considerations

Minimize excessive loading of radius to prevent ulnar positive variance

Supination may become affected in long term

Limited evidence on best surgical option

Intervention: *Radial Head Resection Consequences*

Treatment Algorithm: *Radial Head Fracture (Goal To Regain Pain-free ROM)*

Phase I (0-14 days)

Elbow arom, aarom flex (supine)/ext (seated or against wall with humerus supported)

- **ROM by end of 2nd week -15-105***
- **Putty/grip exercises**
- **Isometric strengthening elbow/wrist/shoulder (submax)**
- **Functional, relevant exercises**

Treatment Algorithm: *Radial Head Fracture (Goal To Regain Pain-free ROM)*

Phase II (15 days- 6 weeks)

Continue elbow AROM/AAROM

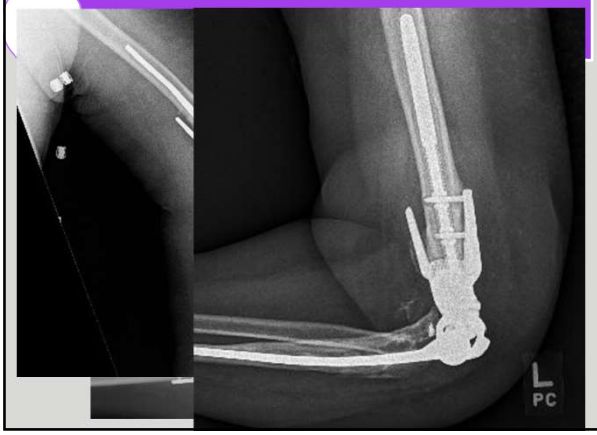
- **Full flex/extension achieved by week 6**
- **A/AAROM supination/pronation**
- **Light isotonic strengthening flex/ext (function based)**
- **Assess/maintain shoulder/wrist strength and ROM**

Treatment Algorithm: *Radial Head Fracture (Goal To Regain Pain-free ROM)*

Phase III (7-12 weeks)

Continue elbow AROM/AAROM, supination/pronation

- **Full supination/pronation achieved by week 8**
- **A/AAROM supination/pronation**
- **Progressively increase isotonic strengthening in flexion/extension, pronation/supination**
- **Address deficits, kinetic chain**



Open/ Closed Chain Exercises

Olecranon Fracture

Intervention: *Olecranon Fractures*
Non-operative treatment

- Increasing prevalence in the elderly population that may not be candidates for ORIF
- Review looked at 70 fractures with average age of 83 yo, 88% female & mean f/u 12.4mo
- 25% of fractures went on to union
- Mean arc of motion 138*
- 92% patients achieved excellent results
- 26% experienced complications: radial head sublux, skin sore, arthropathy, pain, clicking

Alvara et al, 2020; SR L1

Intervention: *Olecranon Fractures*
Non-operative treatment

- 0-2 weeks immobilization (elbow to body sling) 70-90* flexion/neutral forearm

  Goal: To reduce pain and allow for safe healing
- 2-6 weeks of therapy for A/PROM
- 6-8 weeks functional exercises/isometrics and prep for strengthening
- 8 weeks for strengthening, proprioception exercises

Marot et al, 2018; L4

Intervention: *Olecranon Fractures*
Non-operative treatment

Outcomes: *Elbow Fractures*

- Most patients resume normal activity within 6 months
- Full healing can take up to 2 years
- Strength can recover longer than expected- >6mo
- Focus on pain- free function in therapy- NOT FULL MOTION

Della Rocca, G. AAOS 2016

Diagnosis: *Terrible Triad*

Elbow dislocation associated with a radial head and coronoid process fracture

Result of a high energy trauma

Instability of elbow

Associated with outcomes with a high complication rate

Terrible Triad Injuries of the Elbow

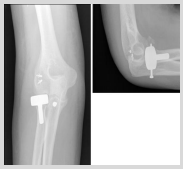
Chen, H. et al. 2016 SR

Diagnosis: *Terrible Triad Complications*

- Stiffness
- Instability
- Pain
- Posttraumatic arthritis
- Heterotopic ossification
- Ulnar Neuropathy

Diagnosis: *Terrible Triad Complications*

- **GOAL:** Stabilization to permit early motion
- **Coronoid Process Fracture**
  Fixed with sutures or lag screws
- **Radial Head Fracture**
  Radial Head ORIF vs. arthroplasty
- **LCL Rupture and possible UCL Rupture**
  Reattached with suture anchors or transosseous sutures



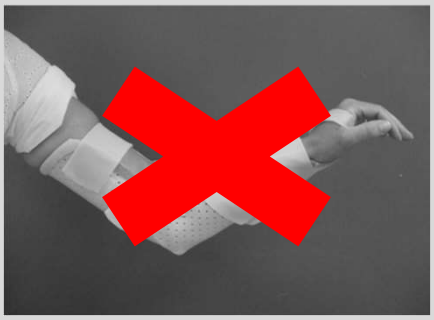
Terrible Triad Injuries of the Elbow

Chen, H. et al. 2016 SR

Diagnosis: *Terrible Triad*
Progression of ROM/Strengthening

- A/AAROM every 2 to 3 hours initially
- Overhead exercises
- 4-6 weeks – Early PROM for flexion
- 6 Weeks – A/PROM all directions can begin
- 8 weeks – Gentle strengthening for elbow flexors/extensors and forearm rotators
- Light hand and wrist strengthening can begin between 2 and 4 weeks postoperatively

Pipicelli, J et al. 2011



Pipicelli 2011

Case Study: *Terrible Triad*

I worked with Dr. Hotchkiss when I was an HSS resident and I also worked with Dr. Lorich at NYP/Cornell and Dr. Helfet at HSS. As a resident, Dr. Lorich instilled the early range of motion protocol for his elbow fractures and fracture dislocations/terrible triads.

Patients were placed in a night extension splint to prevent flexion contractures and allowed to initiate full range of motion both active and gentle passive and active assist post surgical intervention.

This is probably just a difference in philosophy between orthopaedic Traumatologists and the Hand/upper extremity patients.

I have utilized this aggressive range of motion policy since I've been at Cedars in addition to avoiding braces due to the fact that there are heavy and can cause distraction at the joint.

For orthopaedic traumatologist, we are usually not the person performing contracture releases or HO excisions, so starting early range of motion is paramount to preventing us from needing to send patients to a colleague for those procedures. If we can get them moving early, preventing the need for the second procedure, patients are generally very excited.

Hopefully this isn't unreasonable. If there is a patient who has any post op concerns for stability, I will hold range of motion for one week then initiate it with these restrictions for 4 weeks:

Full flexion no rotation limitations
Full pronation and supination at 90 degrees of elbow flexion
Full pronated extension

Case Study: *Terrible Triad*

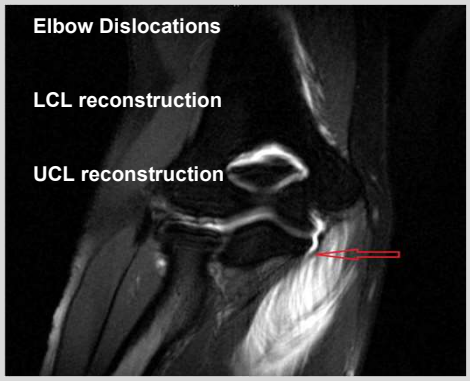
4 weeks post-op

5/17/23
Right elbow (following heat but prior to therapy):
Extension: -30 degrees
Flexion: 95 degrees

Post therapy:
Extension: -23
Flexion: 110 degrees

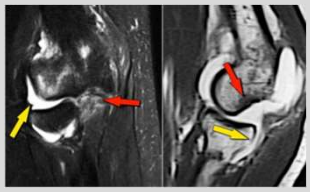
Complications Happen

Ligamentous Instability



Diagnosis: Elbow Dislocations

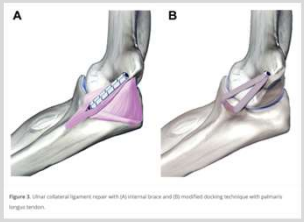
- Simple Vs. Complex Dislocations
- Goal is STABILITY to allow for early active motion
- Safe arc of motion should be established (or extension limited to 60*, increased 10* each week)



Pipicelli et al, 2011; L2

Intervention: Elbow Dislocations

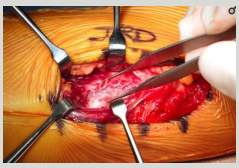
- Internal bracing: collagen coated suture impant acts as a checkrein ligament
  - Decreases stress to repaired ligament



Geissier WB, Purcell KF; 2022 L3

Diagnosis: *Ulnar Collateral Ligament Reconstruction Internal Bracing*

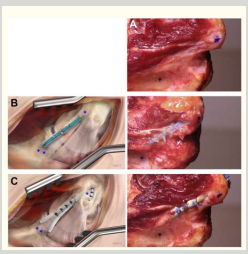
- Novel technique that was first introduced at the Andrews Institute by Jeffrey Dugas and colleagues
- Initial data on UCL repair in athletes was poor & abandoned in favor of reconstruction
- Based on data looking at UCL repairs with anchor only fixation that showed excellent return to play, UCL repair with internal bracing was developed



Dugas et al, 2018; L2

Diagnosis: *Ulnar Collateral Ligament Reconstruction Internal Bracing*

- Cadaveric studies compared modified docking technique vs. UCL repair with internal bracing
  - Elbows placed in 90* flexion, put through 500 cycles of subfailure valgus loading
  - Results: Repair with internal bracing experienced significantly less gapping at the 100th and 500th cycle vs UCL reconstructed arm

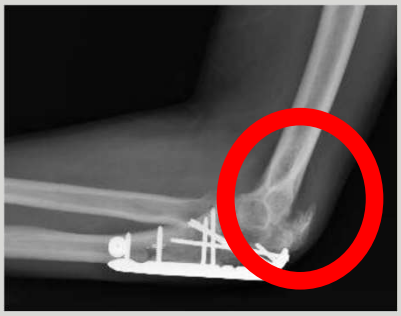


Jones et al, 2018; L3

Interventions: LCL Reconstruction

Wolfe, Hotchkiss 2006

Heterotopic Ossification



Giulia M et al, 2020; SR

Conclusions

- Communication with the surgeon
  - Getting operative report
- Avoid Varus and Valgus stress
- Encouraging healthy behaviors
- Dig in the patients chart for a systems review
- Listen to your therapist!
- Realistic Expectations

Conclusions

- Heterotopic Ossification
  - Radiation to resolve but wounds heal more slowly
  - Protecting nerves
  - Higher energy injuries tend to lead to HO
  - May come from muscle/ tendon damage leading to HO
- Terrible Triads are not all terrible
- Infection is a disaster: goal is infection control
  - Save the patient, then the arm, then reconstruct
- Biologics?
- Amniotic Wraps for nerves?

Conclusions

" I truly think there are three things which allow a good elbow outcome:

Precise surgery

Fantastic patient

Awesome therapist"

Not in that order!

Section 3: Exercise as Medicine

Exercise As Medicine

1. Remediate or prevent impairments
2. Enhance function
3. Reduce risk of injury
4. Optimize overall health
5. Enhance fitness and well-being

Coombes B. (2010; SR)
Beard R. (2018; SR)
King AC. (2018 ;SR)

Exercise As Medicine

Lack of evidence base for much of musculoskeletal medicine when looking at long term outcomes

- Cortisone injection vs. Placebo
- NSAIDS/opiate tablets
- Arthroscopic surgery vs. Placebo

Exercise and physical activity prove to be the most reliable in LONG TERM OUTCOMES for:

Coombes, B. (2010; SR)
Beard, R. (2016; SR)
King AC,. (2018; SR)
Skou ST, et al. (2018, SR)

INJURY PREVENTION
PAIN REDUCTION
INDEPENDENCE

Therapeutic dosage parameters

- Mode of delivery
- Type of muscle contraction
- Type of mobility activity
- Volume
- Frequency
- Intensity
- Duration
- Speed
- Sequencing

Hall, C. (2011; L2)

Specific Adaptations to Imposed Demands: SAID principle

SAID principle based on Wolff's Law, the Physical Stress Theory, and specificity of training concepts

- Muscle/connective tissue will remodel according to stress placed on them
- Physical Stress Theory: Biological tissues have 5 responses to physical stress:

1. Decreased stress tolerance (atrophy)
2. Maintenance
3. Increased stress tolerance (hypertrophy)
4. Injury
5. Death

Frequency **Intensity** **Duration** **Volume**

Exercise Dosage and Therapeutic Applications

Activity Dollars To Be Used

Consider low tissue irritability vs. high tissue irritability

Exercise Dosage and Therapeutic Applications

Overload Adaptation Specificity

For muscle strengthening:

2-3 nonconsecutive days per week

8-12 repetitions to ***VOLITIONAL FATIGUE***

Acceptable VAS during exercise between 2/10-4/10 pain

King AC. (2018; SR)

Joint Integrity, Mobility Impairments & Dosing

- Mobility impairments can result from limited joint, muscle, tendon, or connective tissue extensibility
- Hypermobility/instability included in mobility impairments
- Loss of joint mobility
  > Joint mobilizations, manual work, exercise
- Loss of muscle/tendon extensibility
  > ROM activities (stretching), exercise

Sokka et al., 2008)

Joint Integrity, Mobility Impairments & Dosing

Hypermobility spectrum disorder and hypermobile Ehlers-Danlos syndrome (EDS) require **STABILITY** not **MOBILITY**

- Body blade
- Bruegger wrap
- Isometrics
- Shoulder, elbow and wrist stability
- Core stability
- Work in mid-range

1. De Sire et al, 2023; SR

Goldilocks of dosing

- ***HOW MUCH IS TOO MUCH***

Coombes B. (2010; SR)
Beard R. (2018; SR)
King AC. (2018 ;SR)

Goldilocks of dosing
How much is too much?

- Achieve stable baseline, total exercise volume can be increased
- Frequency, duration, or intensity, # of exercises
- Consider patient's goals, stages of healing, tissue irritability, and comorbidities
- Variety of strategies can be employed:
  - Hard days vs. Easy days
  - Alternating exercises with alt muscle groups vs. Stacking exercises that target same muscles

Gabbett, PJ. (2016; L2)

Goldilocks of dosing
How much is too much?

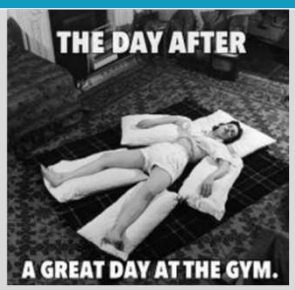
10% Rule

- Small weekly increases in load generally tolerated
- Higher weekly increases can result in specific injury or flare-ups
- Case Example:

Cardi B has been performing 3 sets of 15 reps of scaption exercises 2 days per week using 2# dumbbells (60% of max) 54 units
How would you best progress her after week 1?
a) Increase her weight to 3# (75% of max), no other changes 67 units
b) Increase her frequency to 3 days per week 81 units
c) Add another exercise 108 units

Gabbett, PJ. (2016; L2)
Orchard JW (2020; L1)

Exercise Pre Or Post Manual Work?



Manual Work Pre-Exercise

Hypothesized effects of pre-exercise or pre-event massage include:

- Increased muscle flexibility
- Decreased muscle tension
- Increased performance 2* increased strength
- Increased efficiency of muscles
- Promotion of improved mental state (increased vigor and alertness)

Division Name or Footer

Manual Work Pre-Exercise

Increase in salivary flow rate = increased parasympathetic nervous system activity

- Associated with decreased readiness for action/activity
- Decreased muscle performance
- Pre-activity massage/manual work correlates to increase performance in certain sports

Soft Tissue Work: Gene Expression post workout

- Subjects exercised to "total fatigue" resulting in massive changes in gene expression
- 10 min massage induced signaling pathways responsive to mechanical stresses

Reduced signs of inflammation

Massaged muscle cells better able to make new mitochondria (promoting faster recovery from exercise-induced damage) (1)

Massage did NOT clear lactic acid and glycogen levels remained unchanged (1-3)

Division Name or Footer

Conclusions

- Exercise prescription is a science and an art
- Dosing will vary with each diagnosis, and possibly even each treatment session for the same patient
- There are G A P S in the research
- Be thoughtful in your prescriptions: keep the patient and their goals in mind: independence and compliance is the key to long term success
- We know that exercise has been tried and true for long term overall health and prevention of co-morbidities, pain control, and satisfaction

Section 4: Therapeutic and proprioceptive exercises to gain maximum functional outcomes

INTERVENTIONS & OUT-OF-THE-BOX REHABILITATION

Wessel et al, 2019; L3

Therapeutic Exercise

- Therapeutic exercises
  - Closed vs open chain
  - Proprioception/ joint position sense
- Use and evidence for blood flow restriction therapy
- Theracupping with exercise

Total End Range Time (TERT)

Flowers, K 2012

http://www.ncbi.nlm.nih.gov/pubmed/21430510

Hand (N Y). 2012 Mar; 7(1): 10–17. Published online 2011 Dec 16.

Joint Mobilizations

Ulnohumeral Distraction:

To increase mobility into flexion or extension
Position: Supine with elbow flexed at 70*, BL hands grasp ulna. ***Distal force applied against the proximal ulna***

Humeroradial Anterior/ Posterior Glide:

Anterior glide to increase flexion, posterior glide to increase extension
Position: Supine w/elbow extended and supinated. Stabilize medial distal humerus; proximal palm of stabilizing hand on anterior radial head with fingers on posterior aspect. ***Posterior glide by the palmar aspect of the hand or anterior glide by the fingers.***

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Joint Mobilizations

Proximal radioulnar anterior and posterior glide:

Anterior glide to increase supination

Posterior glide to increase pronation.

Position: Supine w/elbow extended and supinated for posterior glide, pronated for anterior glide.

Stabilize proximal ulna (mobilizing hand on proximal radius). ***Posterior force on radial head for posterior glide, anterior force on radial head for anterior glide.***

Instrument assisted soft tissue mobilization: Cupping

Review Article

Cupping for Treating Pain: A Systematic Review

Research Article

The Effectiveness of Cupping Therapy on Relieving Chronic Neck and Shoulder Pain: A Randomized Controlled Trial

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Blood Flow Restriction Therapy

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Proprioception & Injury

- Proprioception essential to *MOTOR CONTROL* and *JOINT STABILITY (1)*
- Strength training directly affects the functional capacity of the dynamic stabilizers of the body (2)
- Salles JI et al examined 8-week strength-training program on Joint Position Sense (JPS)
  - 3 training sessions/week 2 sets of 10 repetitions:
    Bench Press
    Lat Pull Down
    Shoulder Press
    Seated Row

  Results: Exercises at the same intensity produced improvement in JPS

1. Salles JI et al. (2015; L1)
2. .Basjurt et al. (2011; L3)

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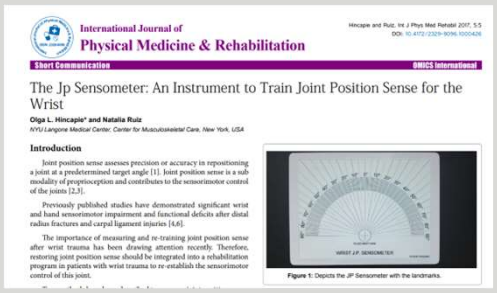
The Role of Proprioception

- Pathological tissue has reduced proprioception (1.)
  - Muscle fatigue increases sensitivity to fusimotor efferents > Decreased efficient intramuscular/intermuscular coordination = poorer proprioception (2.)
  - If therapists improve proprioception, therapeutic results may be achieved sooner & last longer
  - Isometric and closed kinetic chain exercise increases proprioception

1. Juul-Kristensen B et al. (2008; L20
2. Walsh L et al. (2004; L1)

The Role of Proprioception



International Journal of
Physical Medicine & Rehabilitation

Short Communication

The Jp Sensometer: An Instrument to Train Joint Position Sense for the Wrist

Olga L. Hincapie* and Natalia Ruiz

NYU Langone Medical Center, Center for Musculoskeletal Care, New York, USA

Introduction

Joint position sense assesses precision or accuracy in repositioning a joint at a predetermined target angle [1]. Joint position sense is a sub modality of proprioception and contributes to the sensorimotor control of the joints [2,3].

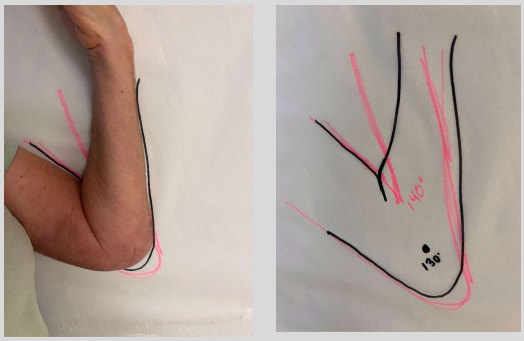
Previously published studies have demonstrated significant wrist and hand sensorimotor impairment and functional deficits after distal radius fractures and carpal ligament injuries [4,6].

The importance of measuring and re-training joint position sense after wrist trauma has been drawing attention recently. Therefore, restoring joint position sense should be integrated into a rehabilitation program in patients with wrist trauma to re-establish the sensorimotor control of this joint.

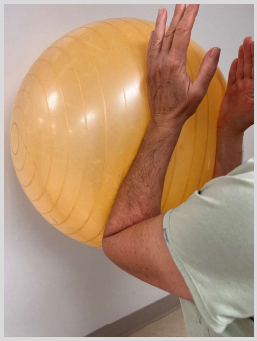
Figure 1: Depicts the JP Sensometer with the landmarks.

1. Hincapie, Ruiz; 2017, L3

Proprioception & Closed Chain Exercises



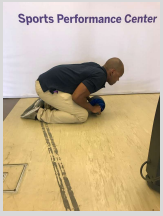
Proprioception & Closed Chain Exercises

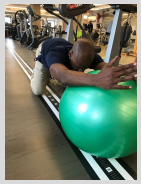


Proprioception & Closed Chain Exercises


DECELERATION


10





Closed chain using wheel
Or physioball

TRX exercises

GOAL OF REHABILITATION

- **A pain-free, functional, and stable elbow**

Thank you!

Courses available online:

- Evidence based rehabilitation to treat flexor and extensor tenon repairs
- Tendon and nerve transfers
- Rehabilitation of the overhead athlete
- Evidenced based rehabilitation to treat elbow trauma

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