

## Taking the Gloves Off - Evidence Informed Manual Therapy For Upper Extremity Conditions: Part II

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## Objectives

- Apply an impairment based evaluation of the Upper Extremity.
- Identify selected OMPT techniques used in the management of elbow, wrist and hand diagnosis.
- Develop a differential diagnoses for conditions in the cervical, thoracic, shoulder, scapular, elbow, wrist, and hand to identify conditions where manual therapy intervention will be most effective.
- Understand recent literature surrounding OMPT for upper extremity conditions.

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## Disclosures

- **Derek Vraa, PT, DPT** - The views expressed herein are those of the individual & do not reflect those of the United States Air Force or the Department of Defense
- **Wil Kolb, PT, DPT** - None
- **Matthew Vraa, PT, DPT, MBA** – I am unfortunately related to one of the other speakers on this panel.
- **Michael Gans, PT, DPT** - None
- **Mary Beth Geiser, PT, DPT** - None
- **Dustin McGann, PT, DPT** - None
- **Jeevan Pandya, PT, DPT** - None
- **Eric Wilson, PT, DPT, DSc** - The views expressed herein are those of the individual & do not reflect those of the United States Air Force or the Department of Defense

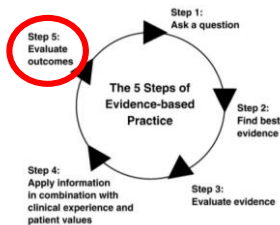
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## Mobilization and Manipulation of the Elbow

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## Steps to use EBP



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## Current Concepts 4<sup>th</sup> Edition<sup>1</sup>

Table 6. Nonoperative Management of Elbow Tendinopathy

Intervention Type	Resource	Description	Outcome/Recommendation
Manual therapy/ Mobilization/ Manipulation	Systematic review <sup>10</sup> with meta-analysis <sup>11</sup>	13 studies met the inclusion criteria. <sup>10</sup> The conclusions of this review expanded upon the recommendations from the Bisset review of 2005.	Support of the use of Mulligan's mobilization with movement at the elbow for short- and long-term outcomes for painfree grip. A potential for improvement with cervical spine manual therapy though more research is needed.
Exercise	Systematic review <sup>10</sup>	11 studies of the use of eccentric exercise with the diagnosis of Achilles, patella, and lateral elbow tendinopathy.	Limited evidence to suggest that eccentric exercise has a positive effect on pain, function when compared to other interventions.

"There is a lack of evidence supporting the effectiveness of eccentric exercise programmes over other active modalities such as CE and stretching"<sup>11</sup>

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### Evidence for treatment of lateral elbow pain

- Dry Needling
  - Case series<sup>4</sup>, case study showing positive results
- IASTM
  - 1 pilot RCT<sup>3</sup>, case series, case studies showing positive results
- Cryiix PT (DFM + Mills)
  - 5 RCTs showing positive results<sup>2</sup>
- Mobilization with Movement + Ex
  - 9 RCTs showing positive results<sup>2</sup>

Does physical therapy work for lateral elbow pain?  
NO!!!!  
Physical therapy is a profession not an intervention!

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### Mobilization with Movement for Lateral Epicondylalgia<sup>5-10</sup>

(Vicenzino 2003, Paungmali 2003, Bisset 2005, Bisset 2006, Herd 2008, Coombes 2013)

#### Indications

Lateral elbow pain reproduced with:

- Resisted wrist extension
- Gripping
- Second or third finger extension pain
- Palpation of the lateral epicondyle

#### When shouldn't I use MWM?

- Radiating pain above and/or below the elbow
  - Think cervical radiculopathy
    - Treat the neck
  - Check the ulna
- Pain is posterior or medial
  - Peripheral nerve entrapment
- Systemic or neurological disorders
- Precautions/Contraindications
  - Surgery, Dislocation, Fracture

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### Bisset. *BMJ*. 2006<sup>9</sup>

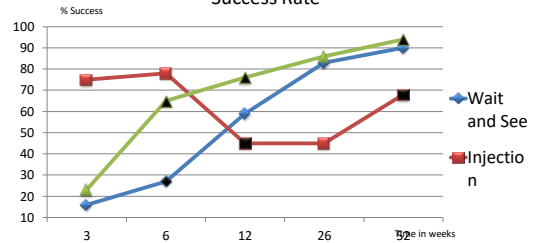
- Randomized Controlled Trial
- 198 patients (age 18-65)
- Three groups:
  - Cortisone Injection
  - Mobilisation with Movement and Exercise
  - Wait and See
- Outcomes:
  - GROC, PFGS, VAS pain
  - PFF questionnaire and assessors rating



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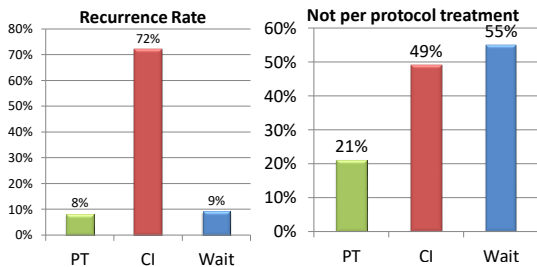
### Bisset. *BMJ*. 2006

#### Success Rate



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### Bisset. *BMJ*. 2006



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### Bisset. *BMJ*. 2006

Additional treatment*	Wait and see (n=62)	Cortisone injection (n=65)	Physiotherapy (n=63)
None	28	33	50
GP/specialist	2	4	1
Physiotherapy	3	3	1
Corticosteroid injection	1	1	0
Elbow support/brace	11	10	2
Analgesic or NSAID	22	20	9
Acupuncture	2	1	2
Complementary medicine	13	12	3

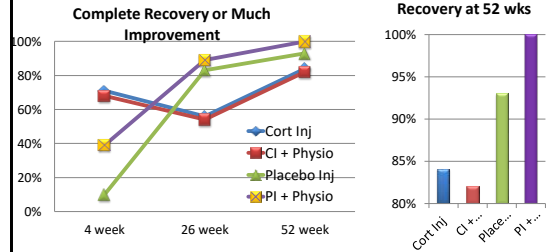
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## Coombes. JAMA. 2013<sup>10</sup>

- Randomized placebo-controlled trial
- 165 patients (mean age 50)
- 4 groups
  - Corticosteroid injection
  - Placebo injection
  - Corticosteroid injection plus physiotherapy
  - Placebo injection plus physiotherapy
- Primary outcome measures
  - Global rating of change 4, 8, 12, 26, and 52 wks
  - 1-year recurrence

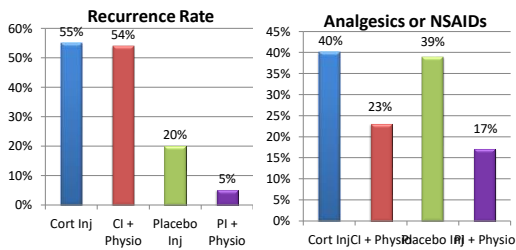
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## Coombes. JAMA. 2013



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## Coombes. JAMA. 2013



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## MWM Lateral Elbow with Belt



**Belt Technique** described for **RIGHT** side  
**Patient position:** supine with **RIGHT** upper extremity internally rotated so that the head of the radius is up towards the ceiling.

**Belt set-up:** mobilization belt is placed around therapist's **LEFT** shoulder & patient's proximal **RIGHT** forearm; therapist's **LEFT** hand stabilizes patient's distal humerus against table while **RIGHT** hand is gently stabilizing (guide wire) patient's distal forearm.

**Perform glide** by **extending knees & lifting left shoulder:** technique **MUST** be pain free; if technique is not pain-free, try changing direction or amount of pull.

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## Radial Head Manipulation

- Use your left thumb to apply a sustained posterior to anterior pressure to the radial head
- Simultaneously flex the wrist and fingers and pronate the forearm to the restrictive barrier
- With the UE slightly abducted, elbow flexed to ~10°, quickly and fully extend the elbow while maintaining firm thumb pressure over the radial head



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## Clinical Pearls

- **GOLD STANDARD**
  - **MWM with or without belt**
  - If it doesn't work, it's because you're not as good at it as....
- Lateral elbow pain AND lacking elbow extension
  - Radiocapitellar manipulation
- Alternatives if MWM unsuccessful
  - IASTM: Graston Technique
  - Dry Needling

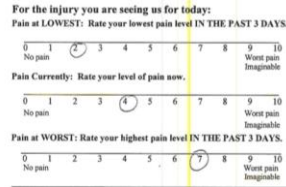
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## Ms. G

- 20 year old female
- College student
- 3 weeks ago (finals week) in dorm room bumped into her dresser and fell out of loft bed within one hour
- Painful swollen elbow, xrays negative for fx
- Numbness, pain, weakness
  - waitressing this summer
- QuickDASH 39%

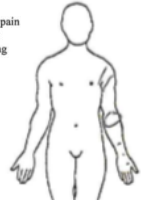
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## Ms. G



**Body Chart:**  
 Please mark the location of your pain and type of pain on the chart:

Key:  
 X Sharp stabbing pain  
 O Dull aching pain  
 ... Numb/Tingling  
 /// Throbbing  
 == Burning



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## Elbow Differential Diagnosis

### Lateral Elbow

- Lateral Epicondylalgia (Tennis Elbow)
- Radial Nerve Entrapment
- Radial Collateral Ligament Instability
- Radio-capitellar overload syndrome
- Cervical nerve root compression

### Medial

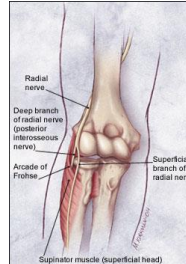
- Tendinopathy (Golfer's Elbow)
- Valgus Instability
- Little leaguer's elbow
- Cubital Tunnel Syndrome

### Other

- Compartment syndrome
- Fracture
- Heterotopic ossifications
- Complex Regional Pain Syndrome
- Median Nerve Entrapment
- Arterial injuries
- Subluxation/Dislocation
- Olecranon bursitis
- Osteochondritis dissecans
- Pannars disease
- Rheumatoid arthritis
- Osteoarthritis

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## Nerve Entrapment



- Deep branch of radial nerve (posterior interosseous nerve) (motor only)
  - Entrapped as it passes under supinator
  - Pain distal to lateral epicondyle
  - Increase in symptoms with counterforce brace
  - Lack of improvement with treatment for LE
  - It may also become compressed from the fibrous bands of the radiocapitellar joint
- Compression or injury of the radial nerve (motor and sensory)
  - Posterior side of the humerus in the radial groove from humeral shaft fractures
  - As it winds to the anterior side of the lateral epicondyle from epicondylar fractures
  - In cases with high radial nerve injury, only the triceps would be spared
    - \* complete absence of the wrist, finger, and thumb extensors
- The superficial branch of the radial nerve may become entrapped as it runs under the tendon of the brachioradialis (sensory only)

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## Mrs. G: Physical Exam

- Cervical AROM: WNL without symptoms
- Shoulder AROM: WNL (Left IR caused elbow pain)
- Elbow AROM: Ext right 10° hyper, Left 2°
  - Flexion full bilaterally
- Strength: PFGS 3.5 lb bilaterally (Norms for 20y/o F 60-70 lb)
  - 5/5 except left supination (4/5 with pain)
- Sensation: WNL light touch and sharp/dull bilaterally
- Hypomobile left humeroulnar and radiocapitellar jts
- ULTT: + Radial left (at 10° elbow flexion)

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## Mrs. G

- Visit 1
  - Pt education
  - Manual Therapy
    - Jt mobs to restore extension
      - Humeroulnar distraction at 90
    - IASTM to lateral forearm
  - Light AROM, stretching
  - Radial nerve flossing
- Goals:
  - Improve Strength
    - 45 lb PFGS bilaterally
  - Carry tray for waitressing
    - Lift 25 lb without pain
- Plan:
  - PT once weekly for 6 weeks

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## Visit 2 (one week later)

- Mrs. G reports work modifications helped
  - Carrying lighter trays with elbow bent vs straight (working 4-6 hr shift)
- Elbow AROM: left 8° hyperextension
- Strength: Supination
  - Elbow bent 4+/5 without pain
  - Elbow straight 4-/5 with pain
- + Radial ULTT (at 0° elbow extension)

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## Visit 3 (one week later)

- Work: up to 12 hr shifts, stiffness and N&T at end of day
- Return of elbow flexion contracture with lateral elbow pain
- Radial ULTT + (at 5° elbow extension)
- Manual Therapy:
  - Varus Mobilization with Movement Grd III
  - IASTM: Graston to Lateral Elbow
  - Post treatment: ULTT + at 0°

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## Visit 4 (two weeks later)

- QuickDASH: 8%
- Elbow ROM: Full
- Strength: PFGS right 55, left 62, left sup 4+/5
  - Weakness in shoulder and scapula noted, ER, Low Trap, Serratus
- ULTT: WNL (light pulling sensation at 10 deg hyperextension)
- HEP focus on shoulder and scapular stabilization

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## Summary

- Clinical Reasoning
  - Know when to use the hammer and when to use the screwdriver
  - Assess your outcomes!
- Mobilization with Movement – JUST DO IT!
  - Reduced recurrence rate versus cortisone injections and wait and see
  - Reduced medication use
- Always prescribe impairment based exercises\*
  - Be cautious with eccentrics



\*Use exercise and HEP in combination with OMPT

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## Mobilization & Manipulation for the Wrist, Hand & CMC Joint

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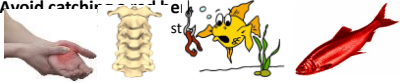


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## Where Should I Start? I Only Have 20 Minutes!

Let's Go Fishing


- 1. Find the biggest fish**
  - Are there CPG's, Cochrane Reviews, Systematic Reviews available supporting manual therapy?
- 2. Fish around for something else**
  - Are there other body regions that might need attention?
- 3. Find the scary hook**
  - What might be keeping a person's hand or wrist sensitized?
- 4. Avoid catching a bad fish**



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## Carpal Tunnel: Yes or No to Manual Therapy?

- What does the evidence say?**



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## Let's Go Fishing

PTNow APTA American Physical Therapy Association

- 1. Find the biggest fish**
  - Are there CPG's, Cochrane Reviews, Systematic Reviews supporting manual therapy?




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## Let's Go Fishing

PTNow APTA American Physical Therapy Association

- 1. Find the biggest fish**
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## Let's Go Fishing

- 1. Find the biggest fish**
  - Are there CPG's, Cochrane Reviews, Systematic Reviews supporting MT?

Too many to discuss, mixed methods & results





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## Let's Go Fishing

- 1. Find the biggest fish**
  - Does finding a school of smaller fish even exist...?

Just 2 examples of many RTCs that are available...




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## Have You Heard This Story Before?

### Typical Complaints

46 y/o female, grocery store clerk

- Progressive onset of hand symptoms, D1-D3
- Numbness at night
- Loss of grip & pinch
- Clumsy hands, fumbles coins.
- Has to shake hands to feel better

### Subtle Complaints

- Difficulty backing up car
- Spinal stiffness awareness after being awoken by hand numbness
- Neck Pain

What would you do?



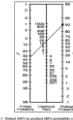
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## Can We Trust What We Find? Was This Validated?

Table 5. CPMI for the Diagnosis of CTS

Criteria for a Positive Test	Sensitivity (95% CI)	Specificity (95% CI)	Likelihood Ratio (95% CI)	Posttest Probability of CTS (%)
≥2 positive tests	.86 (1.4-1.0)	.14 (.23-.23)	1.1 (1.4-1.3)	44
≥3 positive tests	.88 (1.4-1.0)	.14 (.40-.47)	<b>2.1 (1.4-2.8)</b>	52
≥4 positive tests	.77 (.61-.93)	.83 (.73-.93)	<b>4.6 (2.5-8.7)</b>	70
All 5 tests positive	.18 (.03-.31)	.89 (.97-1.0)	<b>18.3 (1.0-328.3)</b>	90

NOTE. Five tests are included in the rule: (1) question 8 (hand shaking improves symptoms); (2) wrist-ratio index < .47; (3) SSS score > 1.8; (4) diminished sensation in median sensory field (1 thumb); and (5) age > 45 years. Useful likelihood ratios appear in bold. The associated posttest probability values are based on a pretest probability of 34%.



30% → 90%  
When  
5/5 Present



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## Let's Go Fishing

1. Find the biggest fish
  - Are there CPG's, Cochrane Reviews, Systematic Reviews available supporting manual therapy?
2. Fish around for something else
  - Are there other body regions that might need attention?

### De-la-Illave-Rincon et al, 2011

Women with carpal tunnel syndrome show restricted cervical ROM

- Case control blinded study
- Regardless of severity, females with CTS exhibited loss of cervical ROM
  - Maybe we should mobilize proximally



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## Can We Trust What We Find?

Cervical Radiculopathy • Wainner et al 57

Table 5. Test Item Cluster for the Diagnosis of Cervical Radiculopathy

Criteria for a Positive Test	Sn 95% CI	Sp 95% CI	LR+ 95% CI	Post-test Probability
Two positive tests	0.39 (0.16-0.61)	0.56 (0.43-0.69)	0.88 (1.5-2.3)	21%
Three positive tests	0.39 (0.16-0.61)	0.56 (0.43-0.69)	6.1 (2.2-18.6)	60%
All four tests positive	0.24 (0.05-0.43)	0.99 (0.97-1.0)	30.3 (1.7-538.2)	90%

ULTA, unrotated cervical rotation < 60°; Distraction, and Souring's A. Sensitivity (Sn), Specificity (Sp), and Positive Likelihood Ratio (LR+) of clinical examination variables with 95% confidence intervals (95% CI). The associated posttest probability values for each criteria level is based on a pretest probability of 23%.



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3. Find the scary hook
  - What might be keeping a person's hand sensitized?



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## Have You Heard This Story Before?

- Widespread pain in the UEs
- Non-anatomical distribution of pain in wrist & hand
- Constant, unremitting or less responsive pain
- Disproportionate, non-mechanical pain
- Mal-adaptive pain
- Augmentation vs. inhibition of nociceptive input

Think central sensitization

**Is manual therapy the best choice here?**



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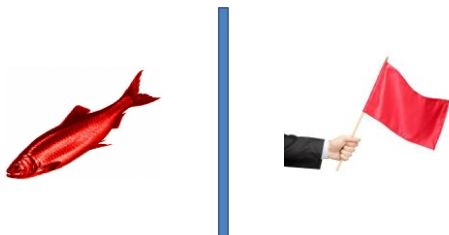
## Let's Go Fishing

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  - Are there other body regions that might need attention?
3. Find the scary hook
  - What might be keeping a person's hand or wrist sensitized?
4. Avoid catching a red herring
  - What might lead you astray?



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## Have You Heard This Story Before?



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## Where Do I Start? Interventions for Wrist & Hand

Fig 1. Longitudinal stretch over the anterior carpal tunnel. Fig 2. Side view mobilization of the proximal carpal tunnel.

Fig 3. Longitudinal stretch over the scaphoid process. Fig 4. Side view mobilization of the scaphoid process.

Fig 5. Longitudinal stretch over the trapezoid process. Fig 6. Side view mobilization of the trapezoid process.

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## Treatment Considerations

<p><b>Direct Manual Therapy – Wrist/Hand</b></p> <p>STM: Wrist Flexors &amp; Thenar Group          Grades III &amp; IV Mobs: Scaphoid/Lunate          Grades III &amp; IV Splay: Carpal Space          Grades I- IV Mobs: CMC Joint          HVLA Thrust: Lunate, Check Scaphoid          HVLA Thrust: CMC Joint          Tendon Glides</p>	<p><b>Regional Interdependence - Cervical</b></p> <p>Grade I – IV Mobs: Cervical PA &amp; Unilateral          SNAGS: Mid Cervical Region          Neuro Flossing: Sliders then Tensioners          Neuro Flossing w/ Cervical Side Glides</p> <p><b>Regional Interdependence – Elbow</b></p> <p>Grade I-IV Mobs          Mobilization with Movement          HVLA Thrust Radial head</p>
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## Discussion – My Clinical Pearls

1. Consider manual therapy at both direct and remote locations as options for treatment
  - Think local & regional interdependence (RI)
2. Numbness/tingling can arise from multiple sources, treat ALL possible sources
  - Think local & regional interdependence (RI)
3. Watch closely for overlap of dermatome and peripheral nerve. Treat nerve exit site and nerve root site.
  - Think local & regional interdependence (RI)
4. Double crush lesions often require treatment at BOTH sites of irritation
  - Think local & regional interdependence (RI)
5. Sometimes treatment at primary site of tissue injury is too sensitized, especially to touch, treat adjacent joints 1st
  - Avoid sensitive site, Think regional interdependence (RI)

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## Oh No...Only a Few Minutes Left (Thumb OA)

Let's Go Fishing (Again)

1. **Find the biggest fish**
  - Are there CPG's, Cochrane Reviews, Systematic Reviews available supporting manual therapy?
2. **Fish around for something else**
  - Are there other body regions that might need attention?
3. **Find the scary hook**
  - What might be keeping a person's hand or wrist sensitized?
4. **Avoid catching a red herring**
  - What might lead you astray?

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## Quick Update... Thumb & CMC OA

1. **Find the biggest fish**
  - Are there CPG's, Cochrane Reviews, Systematic Reviews available supporting manual therapy? **Yes**
    - CPG's: No
    - SR's: Yes
      - **Big Fish:** Berizzo, Valdes, Vanti, Negrini, Piliastrosi & Vitale. Disability and Rehabilitation, 2015. Investigation of the effect of conservative interventions in thumb carpometacarpal osteoarthritis: systematic review and meta-analysis.
    - RCT: Yes
      - **Little Fish:** Vitale, Manji Physiol Ther. 2012; Vitale. Arch Phys Med Rehab. 2012; Vitale. JOSPT. 2013
2. **Fish around for something else**
  - Are there other body regions that might need attention? **Yes**
    - Neck, Elbow, Hand
3. **Find the scary hook**
  - What might be keeping a person's hand or wrist sensitized? **Lots of things**
    - Peripheral or central sensitization
4. **Avoid catching a red herring** **Be careful**
  - What might lead you astray?

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## Thank you!

Jeevan is up next with a case study  
– OA

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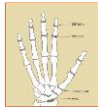
## Case Presentation #2

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## Wrist and Hand OA

- The three most common sites where arthritis happens in the hand are –
  - At the base of the thumb – at the Trapeziometacarpal joint or basilar joint
  - At the distal interphalangeal or DIP joint
  - At the proximal interphalangeal or PIP joint
- Metacarpophalangeal joints are less affected by osteoarthritis.



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## Evidence Of Use Manual Therapy In Wrist And Hand OA

JORGE H. VILAFANE, PT, PhD<sup>1</sup> • JOSHUA A. CLELAND, PT, PhD<sup>2</sup> • CÉSAR FERNÁNDEZ-DE-LAS-PEÑAS, PT, PhD<sup>3</sup>

### The Effectiveness of a Manual Therapy and Exercise Protocol in Patients With Thumb Carpometacarpal Osteoarthritis: A Randomized Controlled Trial

#### Results-

- Combination of joint mobs, neural mobs, and exercise improved pain, pinch strength and grip strength.

### EFFECT OF THUMB JOINT MOBILIZATION ON PAIN THRESHOLD IN ELDERLY PATIENTS WITH THUMB CARPOMETACARPAL OSTEOARTHRITIS

Jorge H. Villafañe, PT, MSc,<sup>1,2</sup> Guillermo B. Silva, MSc, PhD,<sup>1,2</sup> and Josue Fernandez-Camero, PT, MSc, PhD<sup>1,2</sup>

#### Results-

- Passive accessory mobs increased pain pressure threshold at trapeziometacarpal joint.

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## Evidence Continued....

### Radial Nerve Mobilization Decreases Pain Sensitivity and Improves Motor Performance in Patients With Thumb Carpometacarpal Osteoarthritis: A Randomized Controlled Trial

Jorge H. Villafañe, MSc, Guillermo B. Silva, PhD, Mark D. Bishop, PhD, Josue Fernandez-Camero, PhD

#### Results-

- Radial nerve mobilization increased PPT by 3.33kg/cm<sup>2</sup> at thumb carpometacarpal joint.

### HYPALGESIC AND MOTOR EFFECTS OF KALTENBORN MOBILIZATION ON ELDERLY PATIENTS WITH SECONDARY THUMB CARPOMETACARPAL OSTEOARTHRITIS: A RANDOMIZED CONTROLLED TRIAL

Jorge H. Villafañe, PT, MSc,<sup>1,2</sup> Guillermo B. Silva, MSc, PhD,<sup>1,2</sup> Santiago A. Diaz-Panero, MSc,<sup>1</sup> and Josue Fernandez-Camero, PT, MSc, PhD<sup>1,2</sup>

#### Results-

- Joint mobilization reduced pain in the CMC joint and scaphoid bone areas.

### SHORT-TERM EFFECTS OF NEURODYNAMIC MOBILIZATION IN 15 PATIENTS WITH SECONDARY THUMB CARPOMETACARPAL OSTEOARTHRITIS

Jorge H. Villafañe, PT, MSc,<sup>1,2</sup> Guillermo B. Silva, MSc, PhD,<sup>1,2</sup> and Josue Fernandez-Camero, MSc, PhD<sup>1,2</sup>

#### Results-

- Median nerve mobs increased grip strength and reduced pain

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## Case Presentation - Mrs. Smith

### • About Mrs. Smith -

- 65 year old Grandmother of 3 and 5 year old
- Retired school teacher
- Recreational doubles tennis player and works out at gym 3dys/wk
- Works part-time (6-8 hrs/dy x 3 dys/wk) as store receiving specialist at Macy's – job requires lifting and sorting boxes of merchandise

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## Subjective Findings - Mrs. Smith

- **Subjective c/o-**
  - 1 year h/o R wrist and hand pain
  - Gradual onset
  - Pain worse in the morning
  - Increased c/o hand pain, stiffness, and weakness over past 6-8 weeks, especially at the base of the thumb
  - c/o intermittent swelling in the hand
  - No c/o tingling/numbness
  - No c/o cervical spine/shoulder/elbow pain
- **Present Limitations-**
  - Unable to play tennis for past 6 weeks
  - Have reduced her job hours – goes only once a week
  - Unable to carry and play with her grand kids
  - Difficulty with cooking and opening jars.

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## Objective Findings- Mrs. Smith

- Cervical spine, shoulder and elbow AROM – WNL and w/o any symptoms
- R Wrist and Hand AROM–
  - Wrist flexion – 44°
  - Wrist Extension – 40°
  - Radial deviation – 13°
  - Ulnar deviation – 21°
  - Thumb Metacarpophalangeal flexion – 26°
  - Finger PIP flexion (ranged from) – 48° – 57°
  - Finger DIP flexion (ranged from) – 43° – 60°

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## Objective Findings- Mrs. Smith

- Grip Strength –
  - L – 40lb (Norm for 65-69 yr Female – 41.0lb)
  - R – 21lb (Norm for 65-69 yr Female – 49.6lb)
- Tip Pinch Strength –
  - L – 9.8 lb (Norm for 65-69 yr Female – 10.5lb)
  - R – 4.0lb (Norm for 65-69 yr Female – 10.6lb)

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## Objective Findings- Mrs. Smith

- Other Findings –
  - Tenderness at R thumb carpometacarpal joint
  - Presence of Bouchard's and Heberden's nodes
  - Average strength (tested by MMT) in wrist and hand intrinsic muscles 3+/5
  - X-ray findings – Eaton-Littler-Burton stage III CMC joint OA (stage III – Advanced CMC joint space narrowing, sclerosis, and cystic changes with osteophytes or loose bodies >2 mm)

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## Outcome Measure Scores- Mrs. Smith

- **Initial Outcome Measurement Scores-**
  - NPRS – 7/10
  - QuickDash – 44%
  - Patient Specific Functional Scale Scores –
    - Washing dishes – 3
    - Lifting – 3
    - Playing tennis – 0
    - Pushing or Pulling – 4
    - Carrying grandkids – 4
    - Opening Jars – 3

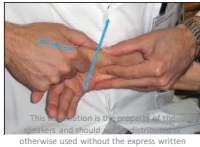
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## Interventions –(0 – 4 weeks)

- 2 sessions/week
- Interventions included –
  - **Manual Therapy** –
    - Grd 3/4 Distal radioulnar joint mobilization
    - Grd 3 Anterior-posterior glides of radiocarpal joint (3 x 30 secs)
    - Grd 3 Anterior-posterior glides of 1<sup>st</sup> carpometacarpal joint (3 x 30 secs)
    - Grd 2+/3 Anterior-posterior glides of all PIP and DIP joints (3 x 30")
    - Median and radial nerve sliders (each performed for 3 min x 2 times)
  - **Exercises**
    - Small Fist making
    - Large fist making
    - Okay Signs
    - Gripping
    - fingertip
    - Scapular strengthening

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## Manual Therapy – Joint Mobilization

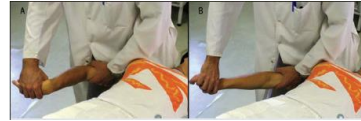


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## Manual Therapy – Neural Mobilization



Median Nerve Sliders



Radial Nerve Sliders

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## 4 Week Follow Up

- R Wrist and Hand AROM–
  - Wrist flexion – 65°
  - Wrist Extension – 56°
  - Radial deviation – 18°
  - Ulnar deviation – 30°
  - Thumb Metacarpophalangeal flexion – 37°
  - Finger PIP flexion (ranged from) – 55° – 78°
  - Finger DIP flexion (ranged from) – 57° – 80°

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## 4 Week Follow Up

- Grip Strength –
  - L – 40lb (Norm for 65-69 yr Female – 41.0lb)
  - R – 30lb (Norm for 65-69 yr Female – 49.6lb)
- Tip Pinch Strength –
  - L – 9.8 lb (Norm for 65-69 yr Female – 10.5lb)
  - R – 6.5lb (Norm for 65-69 yr Female – 10.6lb)

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## 4 Week Follow Up

- NPRS – 3/10
- QuickDash – 25%
- Patient Specific Functional Scale Scores –
  - Washing dishes – 7
  - Lifting – 6
  - Playing tennis – 4
  - Pushing or Pulling – 7
  - Carrying grandkids – 7
  - Opening Jars – 6

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## Interventions – (4-10 weeks)

- Continued of same manual therapy and exercise of 0-4 weeks.
- New Manual Therapy interventions added –
  - Lateral glides of PIP and DIP joints
  - Scaphoid Thrust manipulation
  - Carpal bone flexion and extension manipulation
  - 1<sup>st</sup> CMC joint manipulation
- New Exercises added –
  - Gripping exercises with resistance
  - Tennis specific exercises
  - RTC strengthening exercises

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## 10 Week Follow Up

- R Wrist and Hand AROM–
  - Wrist flexion – 77<sup>0</sup>
  - Wrist Extension – 75<sup>0</sup>
  - Radial deviation – 23<sup>0</sup>
  - Ulnar deviation – 38<sup>0</sup>
  - Thumb Metacarpophalangeal flexion – 55<sup>0</sup>
  - Finger PIP flexion (ranged from) – 70<sup>0</sup> – 85<sup>0</sup>
  - Finger DIP flexion (ranged from) – 68<sup>0</sup> – 80<sup>0</sup>

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## 10 week Follow Up

- Grip Strength –
  - L – 40lb (Norm for 65-69 yr Female – 41.0lb)
  - R – 47lb (Norm for 65-69 yr Female – 49.6lb)
- Tip Pinch Strength –
  - L – 9.8 lb (Norm for 65-69 yr Female – 10.5lb)
  - R – 9lb (Norm for 65-69 yr Female – 10.6lb)

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## 10 Week Follow UP

- NPRS – 0/10
- QuickDash – 6%
- Patient Specific Functional Scale Scores –
  - Washing dishes – 10
  - Lifting – 8
  - Playing tennis – 9
  - Pushing or Pulling – 10
  - Carrying grandkids – 9
  - Opening Jars - 10

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## Key Take Away

- Neural mobilization of Radial and Median nerve can help to reduce pain and increase grip strength.
- Passive accessory joint mobs can help increase pain threshold and improve pinch and grip strength.
- Consider multimodal approach of Joint mobs, neural mobs and exercise

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## Dry Needling in the Upper Extremity

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## Why Dry Needling?

- Pain!
- There is an Opioid crisis in America (2015 statistics)
  - 12.5 million people misused prescription opioids,
  - 33,091 people died from overdosing on opioids
  - 828,000 people used heroin
  - 2 million people had prescription opioid disorder
  - 78.5 billion in economic cost
- Dry needling is not meant to be a stand alone treatment. Rather, it is a adjunctive treatment in a patient's individualized physical therapy plan of care.

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## DN Potential Mechanisms

- Active MTrP - a palpable, hyperirritable nodule located within a taut band of skeletal muscle fibers. With palpation produce pt.'s c/o pain, and predictable referral pattern. They have potential to cause both peripheral and central sensitization.
- Latent MTrP –Only painful with palpation or compression, but may predispose pt.'s to altered movement patterns and/or be converted to Active MTrPs when perpetuating factors are present
- Local twitch response (LTR) is characterized by a visible contraction of part of the taut band in the involved muscle upon mechanical stimulation with needling or palpation to a sensitive site in aMTrP region.
- Needle winding/rotation
- “Is the twitch response the new cavitation?”

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## DN Potential Mechanisms

- Localized changes at cellular level causing dysfunction at neuromuscular junction
- Persistent barrage of nociceptive signals can cause peripheral and central sensitization
- Increased nociceptive signals to supraspinal sites, such as the thalamus and cerebral cortex. Central sensitization may also modulate spinal interneurons and descending inhibitory pathways.
- DN has effects at insertion site, dorsal horn, and in the brain.
- Similar affects from manual therapy as well on supraspinal sites

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## Reliability and Validity

- Lucas. *Clin J Pain*. 2009.
  - Reliability estimates were generally higher for subjective signs of pain reproduction (kappa range, 0.57-1.00) and tenderness (kappa range, 0.22-1.0)
  - Reliability lower for objective signs such as the taut band (kappa range, -0.08-0.75) and local twitch response (kappa range, -0.05-0.57).
- Myburgh. *Man Ther*. 2011
  - good agreement between the experienced pairing ( $\kappa = 0.63$ )
  - moderate agreement between the mixed pairings

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## Boyles. *J Man Manip Ther*. 2015

- The majority of studies indicate that DN treatment decreases pain at various points in time after treatment.
- DN had no significant influence on strength, and variably improves ROM and function.
- Due to methodological issues in these studies clinicians should use clinical judgement for which patient could benefit from DN.
- Future studies should examine the effect of DN combined with mobilization and exercise.

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## Gattie. *J Orthop Sports Phys Ther*. 2017

- First review to investigate dry needling performed by a single health profession (PT's).
- DN had moderate to large treatment effects on both pain and PPT in the immediate to 12-week period compared to no tx. control or sham DN.
- When dry needling performed by PT is compared to other treatments, primarily soft tissue manual therapy techniques, there is moderate-quality evidence to suggest that it is more effective at reducing pain.
- Compared to other treatments, dry needling did not have a significant treatment effect on functional outcomes.
- “Further high-quality studies with long-term outcomes are needed to determine the long-term effectiveness of dry needling compared to other commonly utilized physical therapy interventions on musculoskeletal pain.”

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## Myofascial Research

- Liu. *Arch Phys Med Rehabil*. 2015.
- Ong. *J Bodyw Mov Ther*. 2014.
- Kietrys. *J Orthop Sports Phys Ther*. 2013.

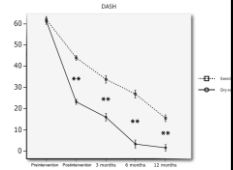
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## Dry Needling in the Shoulder

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## Arias-Burúa. *J Pain*. 2017

- Exercise only vs. DN + exercise
- Two sessions of DN at session 2 and 4
- Both groups experienced similar improvements in pain at 3-, 6-, and 12-month follow ups.
- DN + exercise group had clinically better outcomes in pain-related disability at all follow-up periods compared to exercise only group.



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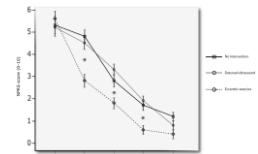
## Pérez-Palomares. *J Orthop Sports Phys Ther*. 2017

- Individualized and EBM PT vs. DN + Individualized and EBM PT
- PT - manual therapy and exercise, 30 min session, 10 sessions, 2x/wk
- DN and PT- 3 sessions of DN on treatment session 1, 4 and 7 (8 days b/t sessions)
- Participants in both groups showed significant improvement post treatment and at the 3-month follow-up.
  - Small improvement in DN+PT compared to PT post treatment, but not clinically relevant.
- Both groups showed improvements in Constant-Murley score, number of trigger points, and change in ER and IR ROM post treatment and at 3-month follow-up.

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## Salom-Moreno. *PM R*. 2017

- Single bout of low load exercise after DN of infraspinatus ms. showed decreased post needling soreness on NPR immediately after, 24 hours, and 48 hours after intervention compared to control and placebo. No significant differences noted after 72 hours.
- All groups showed similar improvements of shoulder pain, DASH score, and SPADI score regardless of treatment groups at 72 hours post intervention.



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## Kopenhagen. *Man Ther*. 2016

- 3 needle insertions (sparrow pecking) for 5-10 sec trying to elicit as many twitch responses as possible in infraspinatus muscle.
- Participants reported clinical improvement on all outcome measures both immediately after dry needling (pain during comparable sign) and 3-4 days afterwards (pain during comparable sign, Penn Shoulder Scale, Global Rating of Change).
- No change in muscle thickness in either group.
- Pressure pain threshold and both internal rotation and horizontal adduction ROM significantly increased at 3-4 days ( $P < 0.01$  for each).

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## Arias-Burúa. *J Manipulative Physiol Ther*. 2015

- PT vs PT with 1 session of DN
- 1 session of PT daily for 5 consecutive days
- PT + DN showed greater improvement in the Constant-Murley total score ( $P < .001$ ) and also activities of daily living ( $P < .001$ ) and strength ( $P = .019$ ) subscales.
- Both groups had similar improvements in pain ( $P < .001$ ) and ROM ( $P < .001$ ).

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## Calvo-Lobo. J Gertatr Phys Ther. 2018

- DN the most hyperalgesic active and latent MTrP vs. DN only at most hyperalgesic active MTrP.
- Statistically significant decrease in pain in the active and latent DN group and increase in PPT compared to the control immediately after intervention and 1 week follow up.
- No significant changes were found in grip strength.

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## Tendon Needling and Tendinopathy

- Krey. *Phys Sportsmed*. 2015.
- Four studies comparing tendon needling (control) vs tendon needling with the addition of either PRP, autologous blood, or autologous conditioned plasma (intervention group).
  - Results showed there is benefit from tendon needling for tendinosis in regard to patient-reported outcomes. However, there is a trend of more improvement noted with the addition of blood products.
- APTA's resource paper on dry needling: "DN is a technique used to treat dysfunctions in skeletal muscle, fascia, and connective tissue"
  - Cost saving, potentially improve blood flow and healing to dysfunctional tendon, and potential for accelerated progression of other PT interventions.

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## DN Safety

- Brady. *J Man Manip Therapy*. 2014.
- 39 physiotherapists participated and 1463 (19.18%) mild AEs were reported in 7629 treatments with TrP-DN.
- Common AEs included bruising (7.55%), bleeding (4.65%), pain during treatment (3.01%), and pain after treatment (2.19%).
- No serious adverse events were reported.
- Researchers estimated upper risk rate for significant AEs (</=)0.04%.

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## Summary

- There is no magic bullet
- Clinical Reasoning, rationale for treatment, and outcome measures
- Evidence Informed Practice - Take into consideration your patient's values
- Find a comparable sign: Test, treat, re-test
- Use DN as an adjunctive to your other treatments-Manual therapy and Exercise.
- Emerging evidence that DN may be beneficial in treating patients with neuromuscular conditions.
- DN may provide potential benefits treating tendinopathy.
- Further research is needed on DN.

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## Mapping the Brachial Plexus: A Clinician's Guide

**Tactical Sports**

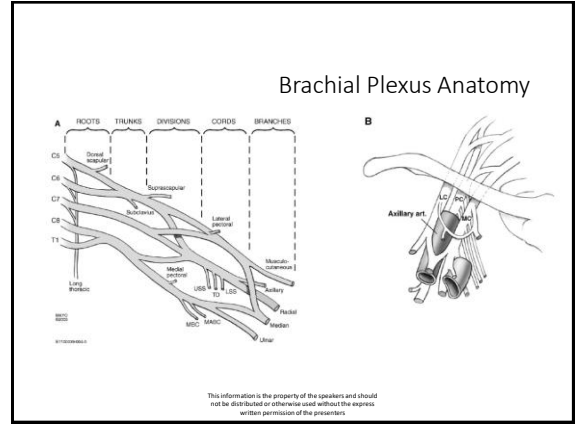


**Fellowship**

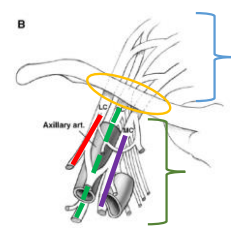
Eric Wilson, PT, DSc  
Director, USAF Tactical Sports & OMPT Fellowship

- Board Certified Orthopaedic Specialist
- Board Certified Sports Specialist
- Certification, Basic Electrodiagnostic Testing
- Certified Strength & Conditioning Specialist
- Fellow, American Academy of Orthopaedic Manual Physical Therapists
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### Brachial Plexus Anatomy



- **Supraclavicular**
  - Roots & Trunks
- **Clavicular**
  - Divisions
- **Infraclavicular**
  - Cords & Branches
- **Axillary artery & Cords**
  - Cords named for their relationship to artery
  - **Lateral, Posterior, Medial**

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### Injury Examples

- **Supraclavicular (most common):**
  - Avulsion injuries after violent lateral head/neck turn away from ipsilateral shoulder
    - C5, C6, C7 root or Upper Trunk disruption
  - Upper limb ABDucted above head with considerable force, possible avulsion injury C8-T1 roots or Lower Trunk
- **Infraclavicular**
  - High energy trauma to shoulder
    - Can be accompanied by rupture of Axillary artery
- **Suprascapular nerve**
  - Excessive protraction
- **Long Thoracic nerve**
  - Traction injury to neck (supraclavicular)  
Sakellariou, ISRN Ortho, 2014

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### Injury Prevalence

- **Supraclavicular Region: 70-75%**
  - 75% of which involve entire Brachial Plexus
  - 20-25% involve C5-C7
  - 2-35% isolated C8-T1
- **Infraclavicular Region: 25%**

Moran, Hand Clinics, 2005

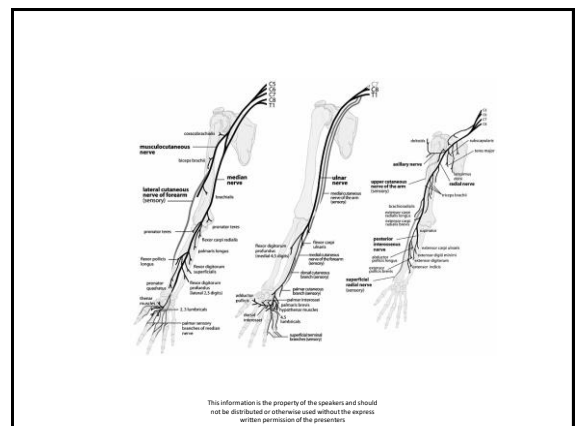
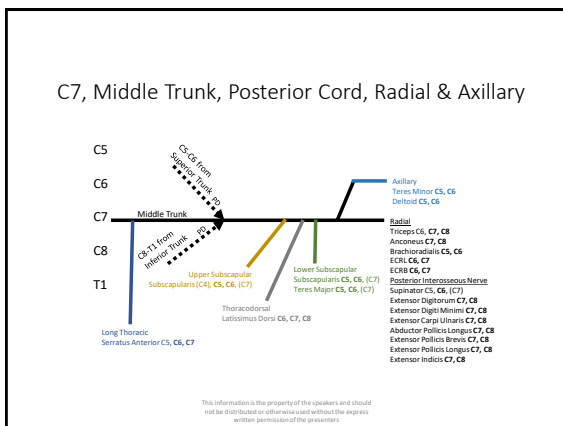
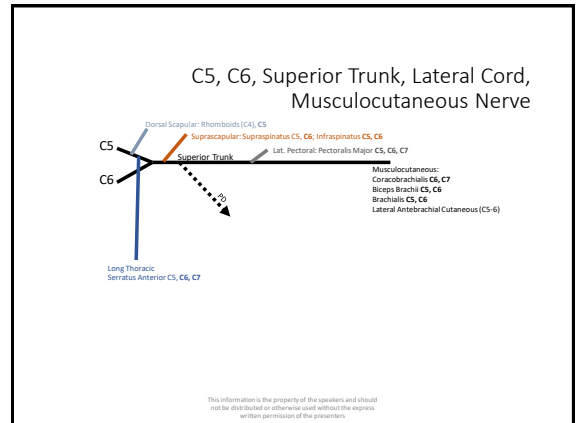
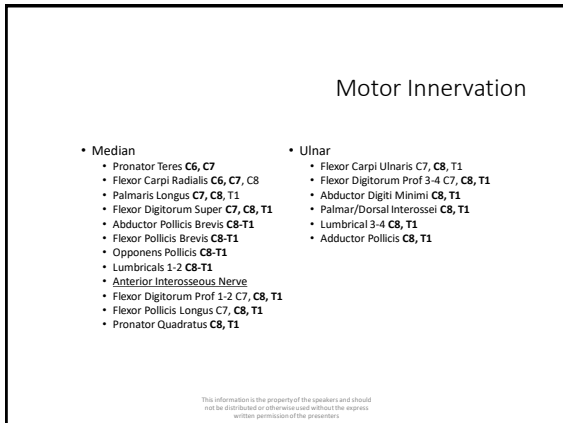
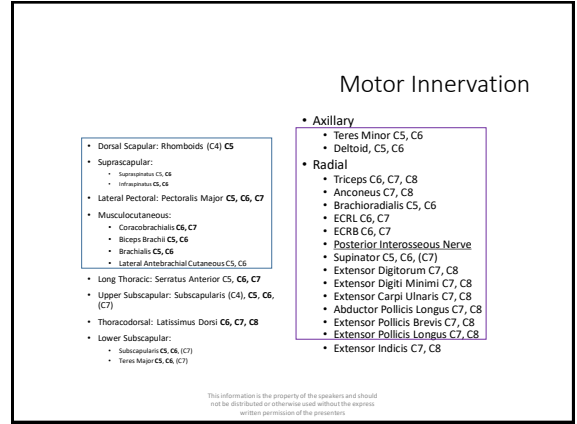
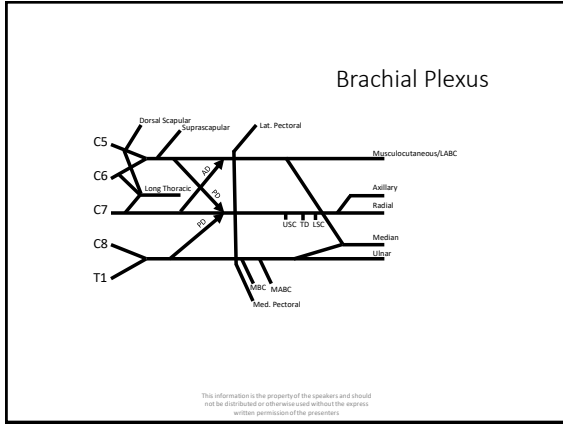
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### Peripheral Nerve Prognostic Factors

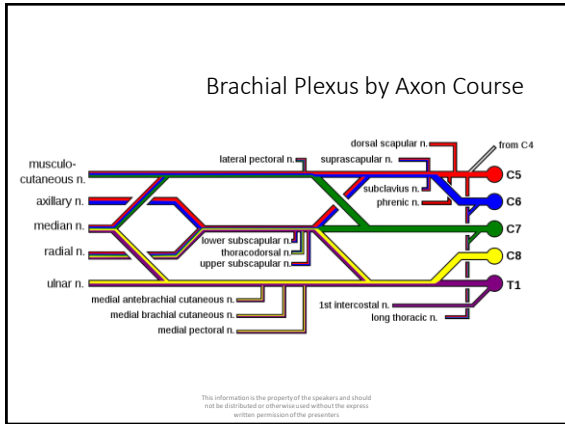
Factor	Result
Mechanism of injury	High energy injuries have worse prognosis
	Avulsion injuries have worse prognosis than acute ruptures
Age	None prognosis with concomitant vascular injury
	Better prognosis in young patients ★
Type of nerve	Exclusively sensory or motor nerves have better functional recovery than mixed nerves ★
	Supraclavicular lesions have worse prognosis than infraclavicular lesions
Level of injury	Upper trunk lesions have the best prognosis ★
	Lower trunk lesions have the worst prognosis ★
Pain	Patients with persistent pain for more than 6 months after traumatic, RPN have less possibilities for recovery ★
	Time of surgical intervention
Other factors	Concomitant diseases (infections, etc.) are related to worse prognosis

Sakellariou, ISRN Ortho, 2014

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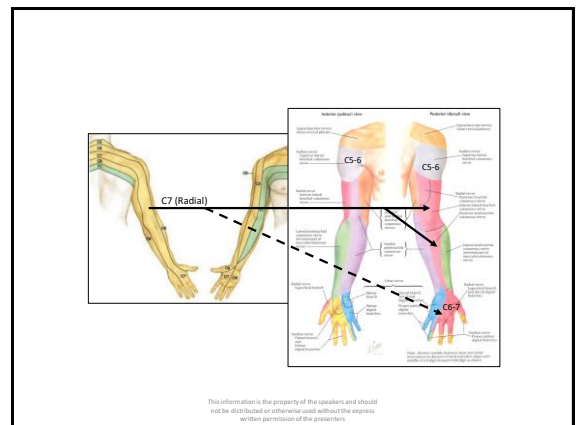
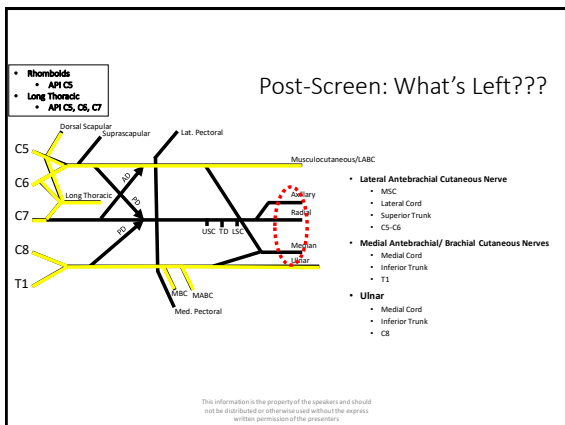
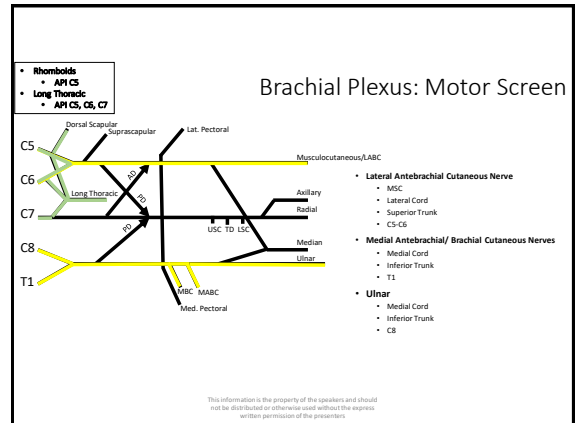
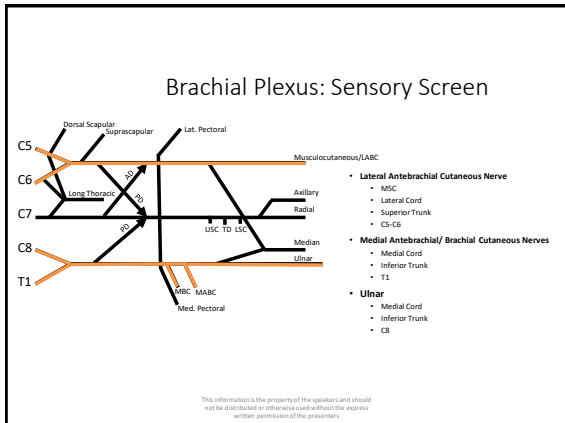
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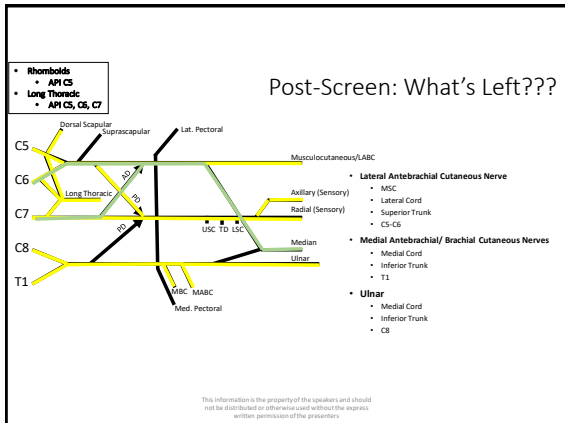
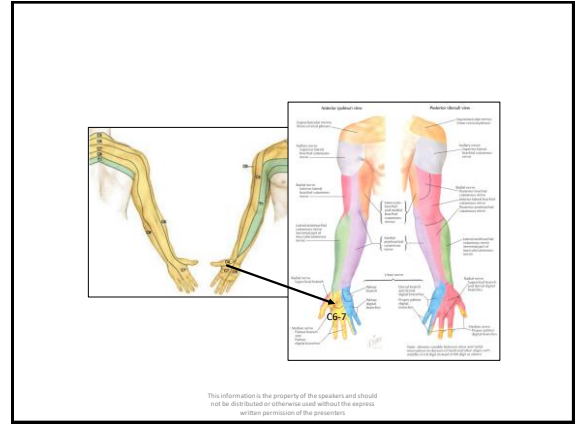
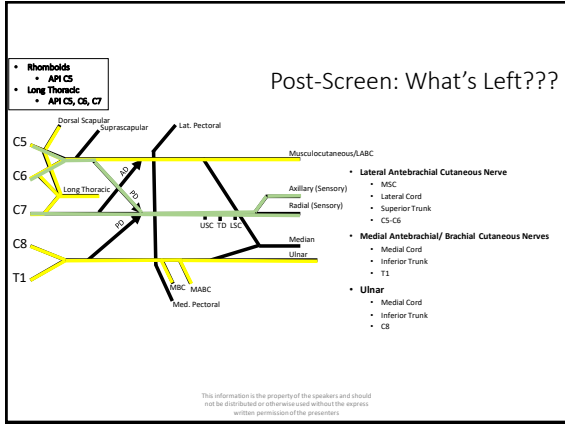
### Sensory Screen

- Lateral Antebrachial Cutaneous Nerve
  - MSC
  - Lateral Cord
  - Superior Trunk
  - C5-C6
- Medial Antebrachial/ Brachial Cutaneous Nerves
  - Medial Cord
  - Inferior Trunk
  - T1
- Ulnar
  - Medial Cord
  - Inferior Trunk
  - C8

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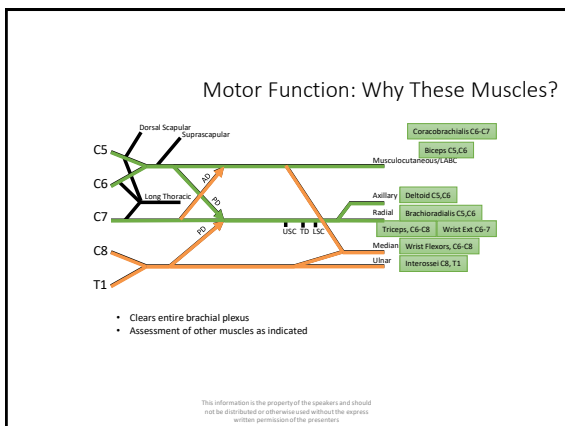


### Motor Function

- Upper Extremity
  - Upper Traps: CN XI
  - Deltoid: C5, C6; Axillary
  - Brachioradialis: C5, C6; Radial
  - Biceps: C5, C6; MSC
  - Coracobrachialis: C6-C7, MSC
  - Triceps: C6-C8; Radial
  - Wrist Flexors: C6-C8; Median
  - Wrist Extensors: C6-7; Radial
  - Interossei: C8-T1; Ulnar

Photos from: Kendall FP, McCreary EK, Provance PG, Rodgers MM, Romani WA. Muscle Testing and Function with Posture and Pain. 5<sup>th</sup> ed. Baltimore, MD: Lippincott Williams & Wilkins; 2005.

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### Simple Composite Screen

<p><b>SENSORY</b></p> <ul style="list-style-type: none"> <li>• LABC (C5)</li> <li>• MABC/MBC (T1)</li> <li>• ULNAR (C8)</li> <li>• AXILLARY (C5-C6)</li> <li>• RADIAL/SRSN (C6-C7)</li> <li>• MEDIAN (C6-C7)</li> </ul>	<p><b>MOTOR</b></p> <ul style="list-style-type: none"> <li>• Upper Traps: CN XI</li> <li>• Deltoid: C5, C6; Axillary</li> <li>• Brachioradialis: C5, C6; Radial</li> <li>• Biceps: C5, C6; MSC</li> <li>• Coracobrachialis: C6-C7, MSC</li> <li>• Triceps: C6-C8; Radial</li> <li>• Wrist Flexors: C6-C8; Median</li> <li>• Wrist Extensors: C6-7; Radial</li> <li>• Interossei: C8-T1; Ulnar</li> </ul>
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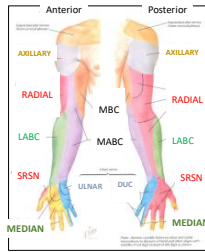
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### Practical Exercise

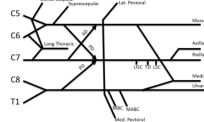
Sensory Screen: Perform sensory assessment on partner using areas below

- AXILLARY (C5-C6)
- RADIAL/SRSN (C6-C7)
- MABC/MBC (T1)
- LABC (C5)
- ULNAR (C8)
- MEDIAN (C6-C7)

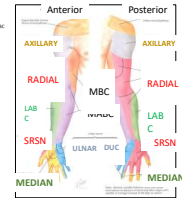


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### Practical Exercise



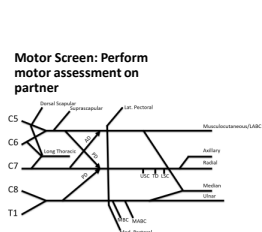
- AXILLARY (C5-C6)
- RADIAL/SRSN (C6-C7)
- MABC/MBC (T1)
- LABC (C5)
- ULNAR (C8)
- MEDIAN (C6-C7)



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### Practical Exercise

Motor Screen: Perform motor assessment on partner



- Upper Traps: CN XI
- Deltoid: C5, C6; Axillary
- Brachioradialis: C5, C6; Radial
- Biceps: C5, C6; MSC
- Coracobrachialis: C6-C7, MSC
- Triceps: C6-C8; Radial
- Wrist Flexors: C6-C8; Median
- Wrist Extensors: C6-7; Radial
- Interossei: C8-T1; Ulnar

Photos from Kendall FP, McCrairy EK, Provenza PG, Rodgers MM, Romani WA. Muscles Testing and Function with Posture and Pain. 5<sup>th</sup> ed. Baltimore, MD: Lippincott Williams & Wilkins; 2005.

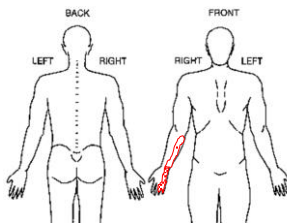
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### Case #1

- 45 year old Division 1 sports coach presents to physical therapist c/o numbness and tingling to right hand palmar 4<sup>th</sup> and 5<sup>th</sup> digits for approximately 6 weeks.
- Symptoms have progressed up into medial aspect of right anterior forearm.
- No known mechanism of injury noted nor substantial change to fitness/lifestyle activities

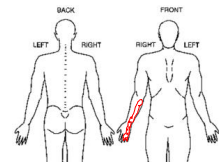
### Body Chart



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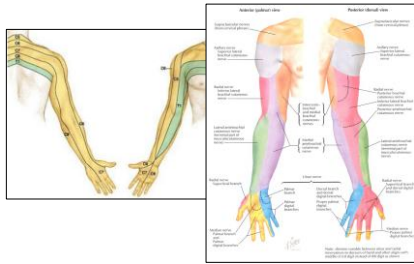
### Questions

1. Do symptoms fall into a specific distribution (dermatome(s) or peripheral nerve(s))
2. If so, is there a distal-most location where entrapment can occur?
3. Is there a MOI that supports these symptoms?
4. Now what?



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### Sensory Assessment

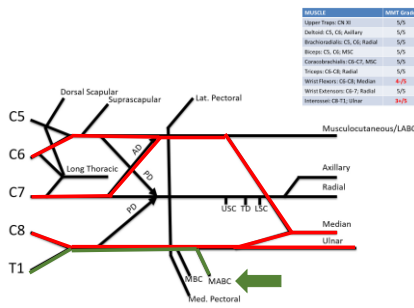


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### Motor Assessment

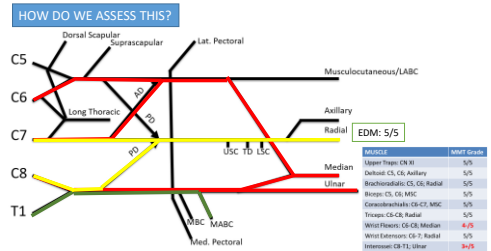
MUSCLE	MMT Grade
Upper Traps: CN XI	5/5
Deltoid: C5, C6; Axillary	5/5
Brachioradialis: C5, C6; Radial	5/5
Biceps: C5, C6; MSC	5/5
Coracobrachialis: C6-C7, MSC	5/5
Triceps: C6-C8; Radial	5/5
Wrist Flexors: C6-C8; Median	4/5
Wrist Extensors: C6-7; Radial	5/5
Interossei: C8-T1; Ulnar	3/5

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### Is it C8-T1, Inferior Trunk, or Medial Cord?



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### Questions and Discussion

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