Unlocking the Mysteries of Diffuse Elbow Pain

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Sponsored by the Academy of Hand and Upper Extremity Physical Therapy

Course Objectives

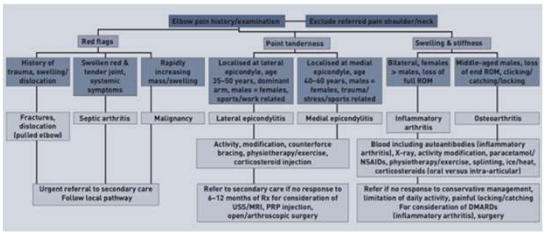
At the completion of this 2-hour session, the participant will be able to:

1. Plan a focused systematic differential evaluation of the elbow based on patient history and location of symptoms.
2. Interpret examination results to establish primary and provisional diagnoses related to the elbow pain.
3. Evaluate examination findings to distinguish which interventions should be used for physical therapy management.

Conflict of Interest Disclosure

No presenter has association or financial involvement with any organization having a financial interest in or financial conflict with the subject matter presented in this educational session. Two of the presenters (AML and JMD) are members of the Clinical Practice Guideline Development group for the APTA.

Primary Care Algorithm for Elbow Pain



Considerations in differential diagnosis

Elbow/Forearm Physical Exam

- Inspection
- Edema measures
- Sensation assessment
- AROM/PROM
- Stress or resisted testing
- Palpation
- Special Tests

Posterolateral Elbow

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Certified Hand Therapist
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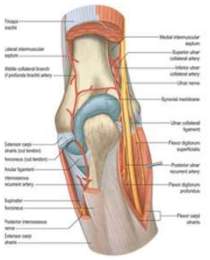
Posterior Elbow Structures

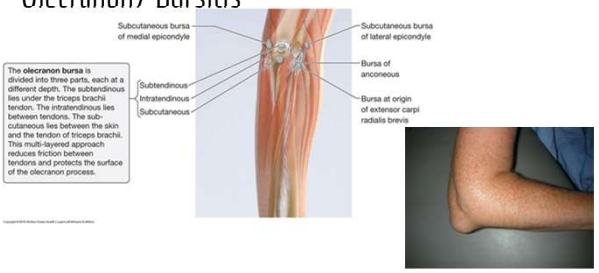
Differential diagnosis considerations:

- ➢ Olecranon fracture
- ➢ Bursitis
- ➢ Triceps tendinitis
- ➢ Snapping triceps
- ➢ Valgus Extension Overload
- ➢ MTrPs



http://stockmarketresources.info/posterior-elbow-anatomy#

Olecranon / Bursitis

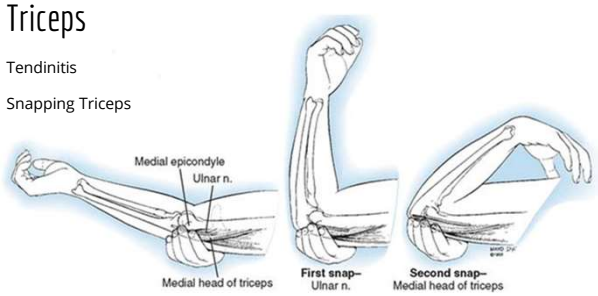


https://orthoinfo.aaos.org/en/diseases--conditions/elbow-olecranon-bursitis

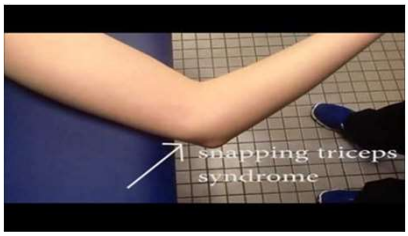
Triceps

Tendinitis

Snapping Triceps



Triceps

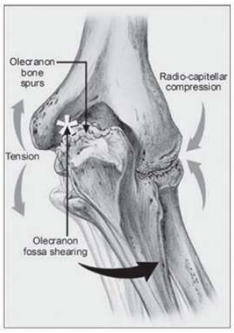


https://youtu.be/_TLkvYVRye4

Valgus Extension Overload

Seen in overhead throwing athletes

Related to hyperextension and valgus forces at the elbow



https://musculoskeletalkey.com/valgus-extension-overload/

Lateral Elbow Structures

- ➢ Pulled elbow syndrome
- ➢ Radial head fracture
- ➢ Posterolateral rotatory instability
- ➢ Posterolateral plica
- ➢ Radiocapitellar chondromalacia

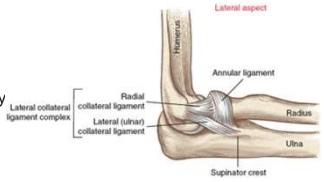


FIGURE 6-14. The components of the lateral collateral ligament complex of the right elbow.

(From Neumann: Kinesiology of the Musculoskeletal System, 2nd edition.)

Radiocapitellar joint - Traction Stresses

Pulled elbow syndrome

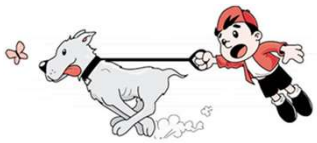


FIGURE 6-25. An example of a cause of "pulled-elbow syndrome" in a child.

(Redrawn from Letts RM: Dislocations of the child's elbow. In Morrey BF, ed: *The elbow and its disorders*, ed 3, Philadelphia, 2000, Saunders. By permission of the Mayo Foundation for Medical Education and Research.)

Radiocapitellar Joint- Compressive Stresses

Radial Head Fractures

Interosseous Membrane Tears

Posterolateral Rotatory Instability

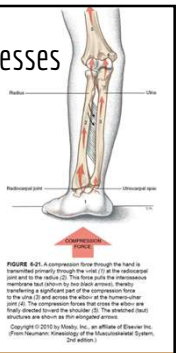


FIGURE 6-21. A compression force through the hand is transmitted primarily through the wrist (1) at the radiocarpal joint and to the radius (2). This force pulls the interosseous membrane taut (shown by two black arrows), thereby transferring a significant part of the compression force to the ulna (3) and across the elbow at the humero-ulnar joint (4). The compression forces that cross the elbow are finally directed toward the shoulder. (5). The stretched (taut) structures are shown as thin elongated arrows.

(From Neumann: Kinesiology of the Musculoskeletal System, 2nd edition.)

Other Radiocapitellar Sources of Pain

- ➢ Posterolateral plica
- ➢ Radiocapitellar chondromalacia

Posterolateral Rotatory Instability

Attenuation/rupture of lateral ulnar collateral ligament

Symptoms may include

- pain, snapping, clunking, or locking when elbow extended and supinated

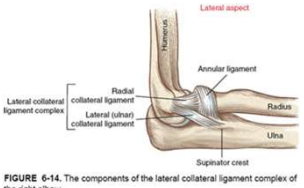
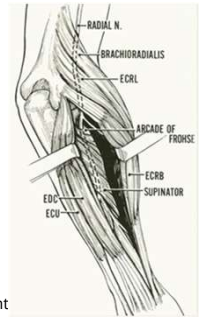


FIGURE 6-14. The components of the lateral collateral ligament complex of the right elbow.

(From Neumann: Kinesiology of the Musculoskeletal System, 2nd edition.)

Lateral Elbow Structures

- ➢ Lateral elbow tendinopathy
- ➢ Radial tunnel syndrome
  - ➢ Fibrotic edge of supinator
  - ➢ Medial edge of ECRB
  - ➢ Fibrous bands anterior to radial head
  - ➢ Leash of Henry vasculature
- ➢Proximal tests to r/o cervical or shoulder involvement

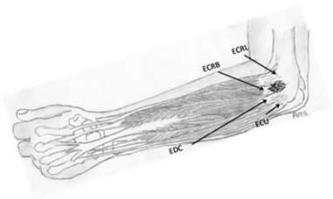


Green's Operative Hand Surgery

Lateral Elbow Tendinopathy

Most common cause of elbow pain[1]

High recurrence rate

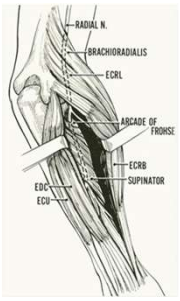


Radial Tunnel Syndrome

3)Fibrous bands anterior to the radial head

4) Leash of Henry

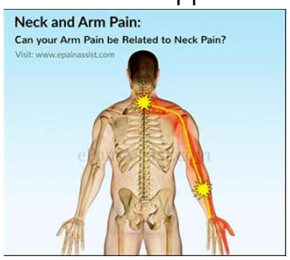
Green's Operative Hand Surgery



1) The fibrotic edge of the Supinator

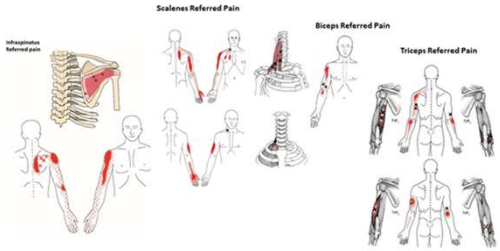
2) The medial edge of the ECRB

Consider proximal sources of pain



https://www.epainassist.com/hands/neck-and-arm-pain

Consider Primary or Associated TrPs



Anteromedial Elbow

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Medial epicondylalgia

- <1.0% of population
  - 45-54 yo
  - Repetitive wrist flexion and pronation with elbow extension
  - Golfers and overhead throwers
  - Forceful work
    - Smokers
  - Diabetes
  - Obesity

Medial epicondylalgia

–Pain with resisted wrist flexion

•Dull ache common at rest

–Examination tests

•Golfer's elbow test

•Polk's test

Medial epicondylalgia

•Examination tests: Active resisted

–Golfer's elbow

•Pt places elbow in slight flexion, makes a fist and attempts to keep the wrist in neutral

•PT applies extension force to wrist (pt attempts wrist flexion) while palpating medial epicondyle

•Positive: pain at medial epicondyle

Medial epicondylalgia

•Examination tests: Active resisted

–Polk's test

•Resistance applied by having patient hold a book

•Positive: pain at medial epicondyle

Medial epicondylalgia

•Treatment

–Sclerosing therapy using polidocanol

–Eccentric training of the forearm muscle over 12 weeks can result in complete resolution of wrist pain.

Neovascularisation of the flexor carpi radialis tendon determined with a power Doppler with an adjunct calcification in close proximity to the pisiform bone before (A) and following sclerosing (B) with 0.25% polidocanol using strict power Doppler control.

BJSM

Cubital tunnel

•Ulnar nerve entrapment or compression

•Examine sensation in distribution of the dorsal cutaneous branch of the ulnar nerve

Branches proximal to the Guyon canal in the wrist

If decreased, compression of ulnar n. is proximal to wrist

Cubital tunnel

- Ulnar nerve entrapment or compression
- Parathesias
- Muscle weakness (C8-T1)
- Usually gradual onset
- Dull ache after activity

Cubital tunnel

- Common in 30-60 yo
  - Manual laborers
  - Athletes
- Hypertrophy
  - Forearm
  - Triceps

Cubital tunnel

- Examination test
  - Elbow flexion test
    - »Pt sitting with bilateral elbow flexion
    - »Holds for 3-5 minutes
    - »Positive test: reproduction of pain, tingling, or numbness along ulnar nerve distribution
    - »Sensitivity: 75-93

Specificity: 99

Cubital tunnel

- Examination test
  - Tinel's (at elbow)
    - »Pt sitting with elbow flexion
    - »PT taps proximal to cubital tunnel
    - »Positive test: reproduction of pain, tingling, or numbness along ulnar nerve distribution
    - »Sensitivity: 70
    - »Specificity: 98

Cubital tunnel

- Intervention
  - Ergonomic assessment
  - Postural education
  - Neural mobilization
  - ULTT ulnar nerve bias stretches
  - Surgery

Ulnar Collateral Ligament

- UCL consists of 3 bands
  - Anterior, posterior, and transverse
  - Anterior band provides most stability during valgus stress

Ulnar Collateral Ligament

•Valgus stress test

Valgus load applied at 70 degrees of flexion

Pain: 65% sensitivity; 50% specificity

Laxity: 100% specificity

Ulnar Collateral Ligament

•Moving valgus stress test

- Valgus applied during throwing motion
- If positive, pain occurs between 70-120 degrees of flexion

Ulnar Collateral Ligament

•Milking Maneuver

- Valgus applied at 90/90
- If positive, pain occurs between 70-120 degrees of flexion

Lymphatic Tissue

Lymph nodes

- Clustered at the medial elbow
- Inflamed nodes may be an alternative source of symptoms-palpable and tender upon palpation
- Requires referral.

Considerations for implementing a regional motor control rehab strategy

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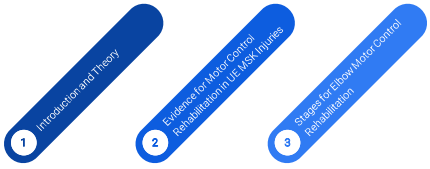
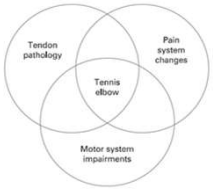
Rehabilitation Strategy Outline



Introduction and Theory

Motor Control in Elbow Rehabilitation:

An Integrative Model (Coombes, Bisset, Vicenzino. *BJSM*, 2011)



Motor Control in Elbow Rehabilitation:

Letter to the Editor; Role of Proprioception in lateral elbow tendinopathy. Journal of Hand Therapy, 2018.

- Proprioceptive rehabilitation appears to be ignored and may be the missing link to improving outcomes.
- Treatment activities may include external bracing, taping, weight bearing exercises, and isometric contractions

Response

- Is reduction in elbow joint proprioception a symptom of sensorimotor incongruence?
- Therefore, we should address
  - Muscle recruitment and force production
  - Coordination and accuracy training
  - Reaction training and variable speed of movement
  - Task specific activities

The Control of Movement: Theories of Motor Control

Motor Control; Translating Research Into Clinical Practice 4th Edition Shumway-Cook 2016.

- Reflexive – stimulus yields a response
- Hierarchical – high centers are in charge of lower centers
- Motor program theory – relearning the correct rules for action – progressing from isolation to a whole
- Systems – synergies allow for a variety of movements – variability of movement
- Ecological – developing multiple adaptive solutions as part of the environment

*No one theory is best; propose using an integrative approach

OPTIMAL Theory of Motor Learning

Wulf and Lewthwaite. *Psychonomic Bulletin and Review*, 2016

Literature

Evidence for using Motor Control in Upper Extremity Rehabilitation Strategies

Shoulder Instability/Impingement

Dynamic motor control of the glenohumeral joint and scapula is an important component of conservatively treating shoulder pathologies and has been shown to be an effective rehabilitation strategy

Coordination of the Scapula

Quality of shoulder elevation and Range of motion

*while incorporating principles of loading

Jaggi, A., & Alexander, S. (2017). Rehabilitation for Shoulder Instability- Current Approaches. *Open Orthop J, 11*, 957-971.
Roy, J. S., Moffet, H., Hebert, L. J., & Lirette, R. (2009). Effect of motor control and strengthening exercises on shoulder function in persons with impingement syndrome: a single-subject study design. *Man Ther, 14*(2), 180-188.
Savoie, A., Mercier, C., Desmeules, F., Fremont, P., & Roy, J. S. (2015). Effects of a movement training oriented rehabilitation program on symptoms, functional limitations and acromiohumeral distance in individuals with subacromial pain syndrome. *Man Ther, 20*(5), 703-708.
Worsley, P., Warner, M., Mottram, S., Gadola, S., Veeger, H. E., Hermens, H., . . . Stokes, M. (2013). Motor control retraining exercises for shoulder impingement: effects on function, muscle activation, and biomechanics in young adults. *J Shoulder Elbow Surg, 22*(4), e11-19.

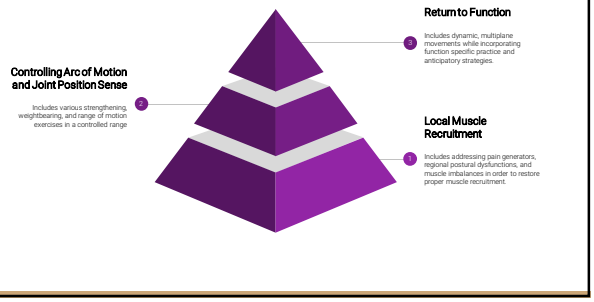
Evidence for using Motor Control in Upper Extremity Rehabilitation Strategies

Elbow

Some evidence exist that fine motor control, muscle firing patterns during grip tasks, and force control of wrist muscles are altered in patients with elbow pain compared to control groups.

Burns, E., Chipchase, L. S., & Schabrun, S. M. (2016). Altered function of intracortical networks in chronic lateral epicondylalgia. *Eur J Pain, 20*(7), 1166-1175.
Skinner, D. K., & Curwin, S. L. (2007). Assessment of fine motor control in patients with occupation-related lateral epicondylitis. *Man Ther, 12*(3), 249-255.
Manickaraj, N., Bisset, L. M., Devanaboyina, V., & Kavanagh, J. J. (2017). Chronic pain alters spatiotemporal activation patterns of forearm muscle synergies during the development of grip force. *J Neurophysiol, 118*(4), 2132-2141.
Mista, C. A., Monterde, S., Ingles, M., Salvat, I., & Graven-Nielsen, T. (2018). Reorganized Force Control in Elbow Pain Patients During Isometric Wrist Extension. *Clin J Pain, 34*(8), 732-738.

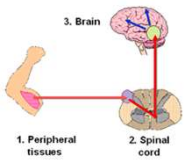
Stages of Rehabilitation: A Regional Motor Control Approach

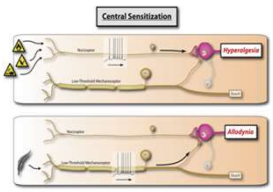


1. Pre-Local Muscle Recruitment

Address pain generators

- Motor imagery
- Pain education
- Tactile discrimination
- Manual techniques
- Physical Agents





Addressing Pain Generators (Neural Sensitization)

Motor Imagery (Moseley, G. L. (2006). Graded motor imagery for pathologic pain: a randomized controlled trial. *Neurology, 67*(12), 2129-2134.)

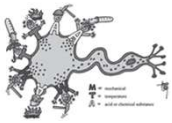
limb laterality, imagined movement, mirror therapy

Tactile Discrimination (Moseley, G. L., Zalucki, N. M., & Wiech, K. (2008). Tactile discrimination, but not tactile stimulation alone, reduces chronic limb pain. *Pain, 137*(3), 600-608.)

detailed object description, specific location of stimulus

Pain Education (Nijs, J., Roussel, N., Paul van Wilgen, C., Koke, A., & Smeets, R. (2013). Thinking beyond muscles and joints: therapists' and patients' attitudes and beliefs regarding chronic musculoskeletal pain are key to applying effective treatment. *Man Ther, 18*(2), 96-102.)

psychosocial factors and beliefs contributing to pain, educate on neurophysiology of pain



Addressing Tissue Pain Generators

Lucado, A. M., Dale, R. B., Vincent, J., & Day, J. M. (2018). Do joint mobilizations assist in the recovery of lateral elbow tendinopathy? A systematic review and meta-analysis. *J Hand Ther*.

Fig. 1 After the most painful area is marked at the lateral epicondyle, dry needling is performed

1. Pre- Local Muscle Recruitment

Address posture and regional deficits

- The short-term analgesic effect of cervical/thoracic manipulation techniques may allow more vigorous stretching and strengthening exercises resulting in a better and faster recovery process of the affected tendon in lateral epicondylitis.
  - Hoogvliet, P., Randsdorp, M. S., Dingemanse, R., Koes, B. W., & Huisstede, B. M. (2013). Does effectiveness of exercise therapy and mobilisation techniques offer guidance for the treatment of lateral and medial epicondylitis? A systematic review. *Br J Sports Med*, *47*(17), 1112-1119.
  - Gonzalez-Iglesias J, Cleland JA, del Rosario Gutierrez-Vega M, Fernandez-de-las-Penas C. Multimodal management of lateral epicondylalgia in rock climbers: a prospective case series. *J Manipulative Physiol Ther*. Nov 2011;34(9):635-642
  - Fernandez-Carnero J, Fernandez-de-las-Penas C, Cleland JA. Immediate hypoalgesic and motor effects after a single cervical spine manipulation in subjects with lateral epicondylalgia. *J Manipulative Physiol Ther*. Nov-Dec 2008;31(9):675-681
  - Fernandez-Carnero J, Cleland JA, Arbizu RL. Examination of motor and hypoalgesic effects of cervical vs thoracic spine manipulation in patients with lateral epicondylalgia: a clinical trial. *J Manipulative Physiol Ther*. Sep 2011;34(7):432-440.
- Why do we see improvement in pain and disability with this intervention?

1. Pre- Local Muscle Recruitment

Address posture and regional deficits

- Scapulohumeral
  - Evidence Exist that patients with lateral elbow tendinopathy present with scapular and shoulder deficits compared to controls
    - Ahrit et al. Middle and Lower Trapezius Strengthening for the Management of Lateral Epicondylalgia: A Case Report. *Journal of Orthopaedic & Sports Physical Therapy*. 2012
  - Not enough evidence to claim that treatment of the shoulder impairments are beneficial
    - Lucado AM, et a. Subacromial impingement syndrome and lateral epicondylalgia in tennis players. *Physical Therapy Reviews*. 2010;15(2):55-62.
    - Day, J. M., Bush, H., Nitz, A. J., & Uhl, T. L. (2015). Scapular Muscle Performance in Individuals With Lateral Epicondylalgia. *J Orthop Sports Phys Ther*, 1-36.
    - Wilk, K. E., Macrina, L. C., Fleisig, G. S., Aune, K. T., Porterfield, R. A., Harker, P., ... Andrews, J. R. (2016). Deficits in glenohumeral passive range of motion increase risk of elbow injury in professional baseball pitchers: a prospective study. *Am J Sports Med*, *43*(9), 2075-2083.

1. Pre- Local Muscle Recruitment

Address posture and regional deficits

- Wrist/Hand
  - Soft tissue restrictions – Intrinsics
  - Joint restrictions – wrist and digits

Fine Motor Considerations (can also address in the functional phase)

1. Pre- Local Muscle Recruitment

Address soft tissue imbalances

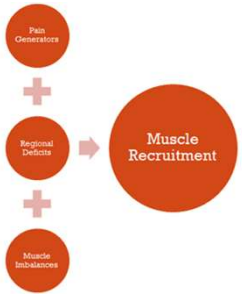
- Proximal imbalances
- Elbow Flexors/Extensors
- Wrist supinators/pronators
- Wrist flexors/Wrist extensors

1. Local Muscle Recruitment

Isometric muscle recruitment

1. Consider muscle length/tension relationships
2. Consider all muscles crossing the elbow
   - Elbow Flexors/Extensors
   - Wrist supinators/pronators
   - Wrist flexors/Wrist extensors

VIDEO



2. Controlling Arc of Motion - Transition from Isometric to Isotonic

Active Assistive Range of Motion

VIDEO

Mobilizations with Movement

VIDEO

2. Controlling Arc of Motion

- Partial ----> Full Range of Motion
  *begin with augmented feedback
  - Visual, Tactile, Verbal
  - Reduce feedback for optimal learning
  - Concentric/Eccentric Strengthening
  - Partial weight bearing exercises
  - Manual stabilization exercises

VIDEO

2. Controlling Arc of Motion

- **Movement Accuracy and Proprioception**
  - (Posada-Gómez R. et al. An Interactive System for Fine Motor Rehabilitation. Rehabilitation Nursing: The Official Journal Of The Association Of Rehabilitation Nurses [Rehabil Nurs] 2018 Mar/Apr; Vol. 43 (2), pp. 116-124.)
    - Designed a system for augmented virtual reality.
    - Results show that patients' fine motor skills improved 10% on average by comparing their error rates throughout the sessions.

VIDEO

3. Return to Function

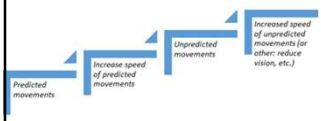
- Dynamic weight bearing
  - Lateral arm walks – progress from half kneeling to full plank position
  - Reverse BOSU semi-circles in plank position
- Plyometrics (ball toss)
- Multiplane Movements (PNF)
- Function specific practice
  - Partial Practice
  - Considerations for cognitive tasks/distractors

VIDEO

3. Return to Function

- Anticipatory Strategies

VIDEO



Motor Control Approach Summary

- In the treatment section of this presentation, we highlight a 3 phase approach to include key components of neuromuscular rehabilitation for the elbow and upper quarter kinetic chain.
- Our patients presenting with elbow dysfunction have a diverse pathogenesis, past medical history, and functional limitations.
- It is important for the clinician to think systematically about where a specific patient is on the continuum of neuromuscular rehabilitative therapy and then modify the examples in this presentation to best suit the patient.

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