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Elbow Stiffness: Biological and Neurological Considerations

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3 Learning Outcomes

- After this course, participants will be able to describe the physiological timing of contracture development.
- After this course, participants will be able to list neurophysiological/occupation-based phenomena associated with the development of elbow stiffness.
- After this course, participants will be able to describe preventative strategies designed to reduce occupational performance deficits with elbow stiffness.
Elbows are built to flex!
30-degree anteversion angle

(*Q1)

The carrying angle

- The angle formed by the long axis of the humerus and the long axis of the ulna.
- The laxity of the radiohumeral joint contributes to an orientation toward valgus.

(*Q2)
Radial Head Anatomy
15 degrees

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Forearm Axis of Rotation
Video of the Mechanics of Flexion/Extension

("Q8")

Video of the Mechanics of Supination and Pronation

("Q8")
Osteokinematic Vs. Functional Movement of the Elbow

- Extension/Flexion (0-145)
- Supination/Pronation (85/80)
- Functional extension/flexion (30-130)
- Functional pronation/supination (50/50)

The Medial Ligaments:
The Main Source of Stability to Valgus Forces.

- Anterior bundle: 3 functional regions
  - Anterior fibers: taut in full extension.
  - Middle fibers: taut in mid range flexion.
  - Posterior fibers: taut with the posterior bundle at end range flexion.
- Posterior bundle: Taut in flexion past 90 degrees. Strengthened by the transverse fibers of cooper’s ligament.
The Lateral Ligaments

- The radial collateral ligament.
- The accessory collateral ligament.
- The lateral ulnar collateral ligament.
- The annular ligament.

(Q5)
Collateral Ligament Function

- Varus-Valgus stability.
- Limitation of internal-external rotation of the ulna on the humerus
- Norms: 5 degrees of medial rotation and 10 degrees of lateral rotation.
- Loss of LUCL is associated with increased ulna external rotation: posterior-lateral rotary instability (PLRI).
Soft Tissue Structures: Joint Capsule

- The anterior capsule lends some stability to the joint.
- Thin, transparent structure.
- Lax in flexion—most capacity at 60-80 degrees.
- Main cause of flexion contracture following injury.
Forearm Rotation

- Integration of the superior and inferior radio-ulnar joints.
- The interosseous membrane binds the forearm bones and maintains alignment.
- Parallel relationship in supination.
- Radius moves on the ulna during pronation.

(*Q6)
Contracture Development

The physiology of stiffness
Contracture Development

Intrinsic Contracture
- Loose bodies
- Joint derangement

Extrinsic Contracture
- Soft tissue contracture
- Exostosis

(*Q7)

Intrinsic Contracture
- Loose body excision
- Plica excision

Typically a high force repetitive motion injury
Extrinsic contracture

- Heterotrophic bone formation
  - By production of the highly vascularized nature of the anterior elbow

Elbow: Predisposition to Pericapsular Stiffness

- Anterior capsule has a high concentration of fibroblasts
- Rapid conversion to myofibroblasts
- Mechanical redundancy
- Confluence to other soft tissue structures
Cellular processes

Cellular processes (cont.)
Capsular Changes

(a) Regular dense

Collagen fibers
Fibroblast nuclei

(b) Irregular dense

Fibroblast nuclei
Collagen fiber bundles

Muscle/Neurological Considerations

Lateral Head of the Triceps
Triceps Tendon
Acumen
Posterolateral Femur
Understanding Torque

- Big MA = Largest Torque
- Small MA = Small Torque
- No MA = No Torque

[Additional images and text related to medical imaging or bone structure are present but not transcribed.]
Postural Considerations

Co-Contraction Phenomena
Co-contraction Phenomena

Grade 3 Monteggia
References:


References:


Questions?

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