

## The Forgotten Soft Tissue

### The Nerves

## ADVERSE NEURAL TENSION

## Things to consider

- Anatomy, biomechanics and pathology related to neural injury
- Adverse Mechanical Tension
- Upper Limb Tension Tests (ULTT)
  - Evaluation
  - Treatment
- Lower Limb Tension Tests

## Adverse Mechanical Tension

- Abnormal physiological and mechanical responses produced from nervous system structures when their normal range of movement and stretch capabilities are tested.
  - Butler DS. Mobilization of the nervous system, 1991



## Nervous System

- Continuous tissue tract – from brain to toes
  - Central nervous system
  - Peripheral nervous system
- Connecting the body for communication of information
- Break in transmission – breakdown of communication

## The Human Nervous system



## Nervous System

- Continuous tissue tract
- Major function is conducting impulses
  - Neurons are interconnected electrically
  - Continuous electrical tract

## Nervous System

- Continuous tissue tract
- Impulse conducting role
- Capable of responding to a wide range of bodily movements
  - Impulse conduction
    - Stretched / shortened
    - Mobile / immobile
  - Elbow
    - Ulnar nerve
    - Median nerve



## Nervous System

- Continuous tissue tract
- Impulse conducting role
- Capable of responding to a wide range of bodily movements
- Limit of range of movement
  - Slump test

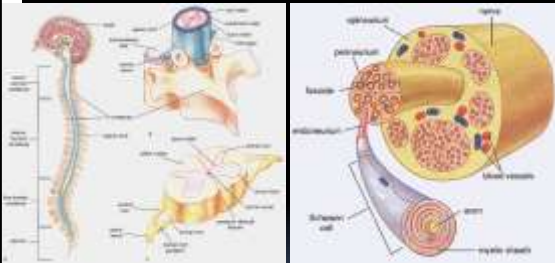
## The Slump Test – Lower Limb Neural Tension



## Anatomy of Nervous System

- Dura, arachnoid, pia mater
- Meningeal attachments in spinal canal
- Epineurium, perineurium, endoneurium

## The Nervous System



## Movement Responses

- Nervous system responses to lengthening:
  - Increased intra-neural or intra-dural pressure
  - Movement

## Movement

- Gross movement in relation to mechanical interfaces
  - Median nerve sliding through the carpal tunnel
  - Dura mater sliding in relation to a vertebral segment
- Intraneural in relation to connective tissue
  - Axons unfold and move
  - Interfascicular sliding in peripheral nerves

## Upper Limb Movement

- In vivo needle insertion of median nerve at mid-arm (n=15)
- Wrist and finger extension pulled nerve down 7.4mm
- Elbow flexion pulled nerve up 4.3mm
- Active and passive movement equal effect
  - McLellan and Swash, J Neurol Neurosurg Psych, 1976; 39

## Areas of Vulnerability

- Mechanical interface
- Tension points

## Mechanical Interface

- 'The most anatomically adjacent tissue to the nervous system that can move independently to the system'
  - Butler D. Aust J Physiotherapy, 1989; 35

## Mechanical Interface

- Osseous
- Fibro-osseous
- Solely soft tissue

## Mechanical Interface

- Extraneural or extradural examples
  - Supinator muscle and the posterior interosseous nerve passing through it
  - Ligamentum flavum and posterior aspect spinal dura
  - Fibro-osseous tunnels

## Mechanical Interface

- Pathological interface examples
  - Osteophytes
    - Osseous or fibro-osseous tunnel
  - Edema and hemorrhage
    - Extraneural scarring of the sciatic nerve following hamstring injury
  - Tight cast or wrap
  - Pneumatic thigh cuff

## Tension Points

- Points along the nervous system which have minimal or no movement in relation to interfacing structures

## Tension Points

- No movement of the spinal cord and meninges to spinal canal at C6, T6 and L4
- Median nerve at the elbow
- Results of
  - Connective tissue interface
  - Blood supply interface

## Peripheral Nerve Injuries

- Friction
- Compression
- Stretch
- Inflammation
  - Secondary injury

## Basis of Symptoms

- Nervous system pathology
  - Mechanical factors
  - Vascular factors

## Mechanical Factors

- Nerve fiber disruption
- Intraneural and extraneural blood vessel rupture

## Vascular Factors

- Persistent pressure results in:
  - Hypoxia
  - Edema
  - Fibrosis
    - Intraneural
      - Alters ability of nerve to stretch
    - Extraneural
      - Alters ability of nerve to glide in its bed

## Nervous System Movement Disorders

- Classify by signs and symptoms
  - Extraneural
  - Intraneural

## Extraneural Pathology

- Involves
  - Mechanical interface
  - Gross movement component
- Symptoms
  - Catch or twinges of pain
  - Short duration of symptoms
  - Lines of pain
  - Mid or through range
  - Symptoms provoked by tension test
    - Eased by tension at 'other end'

## Intraneural Pathology

- Involves
  - Hypoxic nerve fibers
  - Tension component
- Symptoms
  - Persistent
  - Increased duration of symptoms
  - 'Blocks' of pain
  - End range pain and resistance with tension tests
    - Tension applied from 'both ends'
  - Neurological changes

## Treatment Approach

- Maitland grading system
  - Grade II – Large amplitude within midrange
  - Grade III – Large amplitude up to point of limitation
  - Grade IV – Small amplitude movement at the very end of movement

## Treatment by Classification

- Extraneural
  - Through range
    - (Grade II, III, passive physiological)
  - Attention to mechanical interface
    - (joint, muscle, fascia)

## Treatment by Classification

- Intraneural
  - End range tension
    - (Grade III, IV, passive physiological)

## Key to Successful Treatment

- 'Mobilize' the nervous system
- Implies movement and/or tensioning
  
- Prevention is the key
  - Do not wait until symptoms develop

## Evaluative Process

- Hx and physical
- Reflex, strength, sensory testing
- Nerve conduction studies
- Neural tension tests
- Nerve palpation

## Neural Tensioning

- Clinical observations
  - Range of combined movements
  - Resistance at the end range
  - Symptom response
  
- Trying to reproduce the patient's symptoms complaint and location

## Upper limb tension testing

- ULTT<sub>1</sub> – median nerve bias
- ULTT<sub>2a</sub> – median nerve bias
- ULTT<sub>2b</sub> – radial nerve bias
- ULTT<sub>3</sub> – ulnar nerve bias

## ULTT 1 – Median Nerve Bias

- Scapular depression – (hold scapula with one hand while performing motion of the arm with the other hand)
- Shoulder abduction (110°)
- Elbow extension
- Forearm supination
- Wrist and finger extension
  
- Sensitizer: cervical side flexion to the contra-lateral side

### ULTT 2a – Median Nerve Bias

- Shoulder depression
- Shoulder abduction (10°)
- Forearm supination
- Wrist extension
- Finger and thumb extension
- Shoulder lateral rotation
  
- Sensitizer: cervical side flexion to the contra-lateral side

### ULTT 2b – Radial Nerve Bias

- Shoulder depression
- Shoulder abduction (10°)
- Elbow extension
- Forearm pronation
- Wrist flexion and ulnar deviation
- Fingers and thumb flexion
- Shoulder medial rotation
  
- Sensitizer: cervical side flexion to the contra-lateral side

### ULTT 3 – Ulnar Nerve Bias

- Shoulder depression
- Shoulder abduction (10° to 90° - hand to ear)
- Elbow flexion
- Forearm supination
- Wrist and finger extension and radial deviation
- Shoulder lateral rotation
  
- Sensitizer: cervical side flexion to the contra-lateral side