FUNCTION OF NEURAL STRUCTURES (Shaddock)

- Physiological
  - Intraneural blood flow
  - Impulse Conduction
  - Axonal transport

Peripheral Nerve
Peripheral Nerve

- Perineurium creates a closed compartment
- Positive endoneural pressure
- Oedema can spread longitudinally
- Intraneural scarring

Intra neural pathology
- Ischemic Insult – compression, elongation, physical disruption
  - Neuropraxia
  - Axonotemesis
    - Wallerian degeneration/regeneration
  - Neurotomy
  - Root Avulsion

Axonal Conductivity
- Level 2 Theory Manual

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010
Axonal Transport

- Impedance to the axonal transport will impact availability of neurotransmitter at the synapse and nutritive substances to the target tissue.
- Retrograde flow signals the dorsal root ganglion on state of target tissue and nerve.

FUNCTION OF NEURAL STRUCTURES (Shacklock)

- Mechanical
  - Tension
  - Movement
  - Compression

TENSION (Shacklock)

- Perineurium
- Cabling of the peripheral nerve (PN)
- Allows PN to withstand 18 to 22% strain before failure
MOVEMENT: SLIDING
(Shacklock)

- Longitudinally
- Transversely
- Dissipates tension and pressure in the nerves

COMPRESSION (Shacklock)

- Change shape according to pressure exerted on them
- Clinical value are movements about the mechanical interface
- Epineurium: padding protects axons from excessive compression (gives spongy quality)

MOVEMENT OF JOINTS (Shacklock)

- If the nerve lies on the convex side of the joint, it is subject to elongation forces
- If the nerve lies on the concave side, it is subject to shortening forces
- Capacity of nerves to “lend” their tissue and slide in the direction of the joint from both ends of the nerve tract
- More than 1 joint movement reduces the capacity of the nerve to slide or lend their tissue
**Mechanical Interface**

- Tissue or material adjacent to the nervous system that can move independently of the system
  - Ligamentum flavum to posterior aspect of spinal dura mater
  - Z joints to nerve roots and vascular structures

**MECHANICAL INTERFACE**

- Nerve Bed
- Tendon
- Muscle
- Bone
- IV disc
- Ligaments
- Fascia
- Blood Vessels

**Pathological Interfaces**

- Osteophytes
- Ligamentous swelling
- Fascial scarring
- Blood, edema
- Affects the ability of the nerve to slide in relation to the interface
The dynamics and the associated sensitivity of the nervous system can be tested (Butler)

Listen For
- Non segmental patterns
- “Linking” symptoms
- Variable locations, Lines of pain
- “burning, pulling, tight, heavy, feeling swollen”
- AM stiff, worse in PM
- Association with a particular nerve

Look For
- Antalgic Postures
- Active movement pattern of avoiding neural tension positions

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010
Precautions to Assessment & Treatment (Butler)

- Recent onset or worsening neurological signs
- Cauda Equina Lesions
- Cord Signs - Tethered Cord Syndrome

Contraindications to Assessment & Treatment (Butler)

- Recent onset or worsening neurological signs
- Cauda Equina Lesions
- Cord Signs - Tethered Cord Syndrome

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010

Examination of the Nervous System (Butler)

1. Palpation of nervous system
2. Active & Passive Neurodynamic tests
3. Manual Examination of Conduction

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010
Neurodynamic Tests: 
Guidelines (Butler)

- Active test first when possible
- Consistent starting position
- Constant communication with your patient
- Ideally, performed identically as part of the scan
- Later, variations in component sequencing can be altered to load different parts of the system

Guidelines (cont’d)

- Feel for barriers to movement, note onset of resistance or if there are other symptoms
- Note pain response including area and nature
- Test for symmetry between sides
- Positive: test response altered by movement of unrelated body parts
- “The” symptom does not have to be reproduced

Positive Test: (Butler)

- Mechanics of nervous system are normal but part of the nervous system may be irritated
- Mechanics of the nervous system are altered
ULNT #1: Active Test

- Look at palm of hand
- Extend elbow
- Extend arm out sideways with hand held forward until raised above head
- Extend wrist & move head away from test side

ULNT #1: Passive Test

- Shoulder abduction
- Wrist & finger extension
- Forearm supination
- Shoulder lateral rotation
- Elbow extension
- C lateral flex away & towards

Normal Response ULNT #1

- A) Stretch cubital fossa
- B) Radial aspect hand
- C) Tingling thumb, index middle fingers
- D) Anterior shoulder
ULNT #2 A (Median): Active (Butler)
- Arm by side, patient looking at thumb
- Point thumb away, extend wrist
- Push hand towards the floor
- May add C lat flex away

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010

ULNT #2 A (Median): Passive Test (Butler)
- Shoulder girdle depression
- Elbow extension
- Lateral rot
- Wrist / finger extension
- Shoulder abduction

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010

ULNT #2 B (Radial): Active (Butler)
- Arm by side, flex wrist
- IR arm, look at palm over shoulder
- IR shoulder, pronation of forearm

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010
ULNT #2 B: Passive Test  (Butler)

- Shoulder girdle depression
- Elbow extension
- Arm IR
- Wrist flex
- Optional: finger flex, thumb flex, U dev

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010

ULNT 2B: Normal Response  (Butler)

- A) Strong painful stretch radial aspect forearm
- B) Strong stretch biceps
- C) Stretch over dorsal aspect 3-5 fingers

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010

ULNT #3 (ulnar): Active  (Butler)

- Hold hand to side as though holding tray
- Look away
- Add more elbow flex or depress shoulder girdle
- If symptoms not reproduced, attempt Mask position

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010
ULNT # 3: Passive Test
(Butler)

- Wrist/ finger extension
- Forearm pronation
- Elbow flexion
- Lateral rotation
- Sh girdle depression

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010

ULNT #3 : Passive Cont'd

- Shoulder abduction

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010

Guidelines to Neural Mobilisation (Butler)

Remember that S & S may alter with treatment of non-neural tissues including mobilization, exercises and postural awareness

All that may be required during treatment is reassessment to ensure neurodynamics are improving

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010
### Treatment Guidelines for Irritable/Pain Dominant State

**Butler**

- **Pain before resistance:**
  - Rest in unloaded position, taping, change of body mechanics
  - Start in neurally unloaded positions
  - Movements should be free of barriers, non-provocative (short of pain)
  - Movement away from injury site
  - Mobilize the less sensitive component first

### Treatment Progression

**Butler**

- Large movements are better for gliding nerves through tunnels
- If passive movements are successful, integrate active mobilizations
- Increase the number of repetitions
- Increase the strength of technique
- Progress technique after 2 to 3 treatments

### Non-irritable State

**Butler**

- **Resistance before pain**
  - Technique can go into resistance (try to stop short of pain)- Very chronic may go into some pain
    - Pain should stop within a few seconds of unloading tissue
    - P & N should disappear within 10 to 15 seconds
  - Movement taken up first allows better challenge of neural tissue at that site
  - Mobilize the joint component of pathology while neurally loaded
Treatment Approaches

- Mobilize interface structures out of, then towards tension position
- Start with remote component, pain free oscillatory movements
- Gliding vs. Tension movements

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010

Effects of Treatment (Butler)

- Increases blood supply & axoplasmic flow
- Mechanical dispersion of intraneural edema
- Decreases connective tissue entrapment
- Normalizes pressure gradients
- Increases CSF circulation

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010

References

- David Butler “Course Notes: The Sensitive Nervous System” 2001
- Shacklock, Michael: Clinical Neurodynamics (2005.) Elsevier
- Theory Manual Notes: 292-301; 24-96

Prepared by Teresa Gravelle BScPT, MClScPT, FCAMT, Level 3 Upper, 2010
References

- Butler, Mobilization of the Nervous System, 1991
- Reid, Sports injury Assessment and Treatment, 1992
- Walsh, “Upper Limb neural tension testing and mobilization: fact, fiction, and a practical approach” ODR Nov/Dec 2005
- Shalock, “Advances in diagnosis with neurodynamic tests” ODR Nov/Dec 2005
- Hall, Elvy, “Management of Mechanosensitivity of the nervous System in Spinal pain syndromes” ch 29 Grieve’s MMT 2004

- Albert, S et al 1981. Axonal Elongation into PNS bridges after CNS injury in adult male rats
- Basbaum, Julius, “Toward better pain control” Scientific American, June 2006