

NDS  
Neurodynamic Solutions

Providing practical solutions for clinical therapists



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**NO RECORDING!**

**OK!!**

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NDS Upper Quarter Course Aims

Improve/develop:

- **manual skills**, specifically the ability to **feel abnormalities in movement** related to the nervous system in the upper quarter
- abilities in **diagnosis and interpretation** of upper quarter neurodynamic testing and musculoskeletal relationships
- clinician's **repertoire of diagnosis and treatment** of techniques
- **safety** in relation to clinical neurodynamics



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DR ALF BREIG - Swedish Neurosurgeon (1910-2006)  
Original founder of adverse neural tension

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Dr Alf Breig's Pioneering Work



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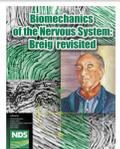
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Dr Alf Breig's Pioneering Work



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### Problems with 'Tension'

Makes us think of tightness in nervous system

Corollary is 'stretch'

Stretch:

- can cause injury
- can increase pain
- often ineffective
- caused therapists to abandon the approach



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### Concept of Neurodynamics

Many other aspects were being omitted:

- sliding, pressure
- physiology
  - intraneural blood flow
  - mechanosensitivity
  - inflammation in neural tissues

Challenge the word 'tension'



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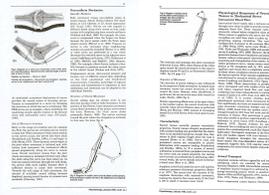
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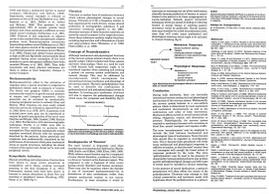
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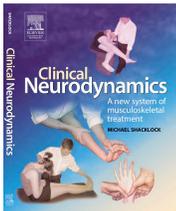
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### Concept of Neurodynamics (cont.)

Must link mechanics and physiology and function of the musculoskeletal system  
Shacklock 1995 Physiotherapy

**Clinical Neurodynamics Definition** - clinical application of mechanics and physiology of the nervous system as they relate to each other and are integrated with musculoskeletal function



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### Benefits of Clinical Neurodynamics

Safer - less stretching of nerves

Links diagnosis and treatment to causal mechanisms

Integrates neural aspects with the musculoskeletal system

Systematic



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### General Neurodynamics

**Definition**

Principles of clinical neurodynamics that apply to the whole body no matter what region. They are therefore general or universal principles.



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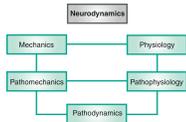
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### Concept of Neurodynamics (cont.)



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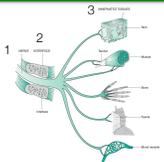
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### Three Part System



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### Nervous System Primary Functions

Withstand tension



Position a



Position b

- 18%-22 elongation before failure  
- varies between individuals and between specific nerves



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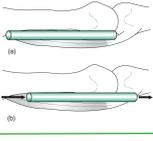
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Nervous System Primary Functions

Sliding - longitudinal



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Longitudinal sliding  
prevents  
excessive tension.

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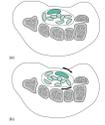
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Nervous System Primary Functions

Sliding - transverse



Transverse movement of the median nerve at the wrist  
1-5 mm  
Nakamichi and Takibana 1995  
Greening et al 1999

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Transverse sliding prevents  
excessive compression.

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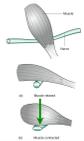
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Nervous System Primary Functions

Compression



Compression of nerve during daily movement

Similar events occur with joints and fascia

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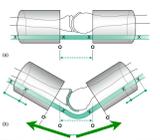
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Three Ways to Move Nerves

1. Move the joint



Force direction is away from the joint.

DIFFERENT FROM direction of movement.

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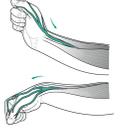
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### How Nerves Move

#### 2. Move the Innervated tissues



- Other nerves:
- ulnar
  - median
  - motor branch (median)
  - digital
  - axillary
  - musculocutaneous



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### How Nerves Move

#### 2. Move the Innervated tissues



- Other nerves:
- femoral
  - peroneal
  - sural
  - tibial
  - medial calcaneal
  - lateral femoral cutan.



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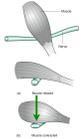
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### Ways to Load the Nervous System

#### 3. Move the interfacing soft tissues



- muscle
- fascia



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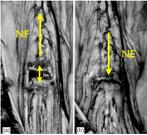
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### The Nervous System is a Continuum



Breig 1978

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### Structural Differentiation

#### Definition

When the therapist moves the relevant neural structures (remotely) without moving the adjacent musculoskeletal structures.

The nervous system is emphasized.



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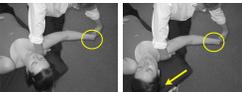
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### Structural Differentiation (UQ)

Wrist symptoms - contralateral lateral flexion



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The Nervous System is a Continuum  
(cont.)

Offers us structural differentiation



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Structural Differentiation (Lumbar)

Release neck flexion (RNF) for lumbar symptoms



Full slump

Release neck flexion

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Structural differentiation is used in

**ALL**

neurodynamic tests in diagnosis

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Transmission of forces along the system

Type of neural effects during neurodynamic technique:

- early in movement - taking up slack
- mid range - sliding effects
- end range - tension effects

Charnley (1951), McLellan and Swash (1976), Wright et al (1996)

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Gives Us Progressions

Early in movement - just apply small force to nerve without producing significant movement

Mid range - produce sliding

End range - apply tension

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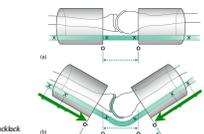
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Convergence



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Nerves move toward the joint at which tension is being applied.

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### Neurodynamic Sequencing

#### Summary

- The sequence of movements influences the location of symptoms.
- more symptoms at the region that is moved first and most strongly (distal)
- eg. foot - peroneal nerve (Shacklock 1989)
- upper limb (Zorn, Shacklock & Trott 1995)

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### Neurodynamic Sequencing



Tsai 1995  
- almost 20% more strain in nerve with local sequence

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### Neurodynamic Sequencing

Tsai 1995 - cadaver study on ulnar nerve

- proximal-to-distal sequence
- distal-to-proximal sequence
- elbow first sequence

Greater strain in the ulnar nerve at the elbow with the **elbow first** sequence (approx. 20%)

Intraneural tension reflected this change.

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### Neurodynamic Sequencing

#### General principles

- Sequence of movements influences local tension and strain in the neural tissues.
- Greater strain in nerves occurs where the force is applied first and most strongly.
- This translates into changes in symptom responses with human subjects.

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### Neurodynamic Sequencing

#### Implications

- Consistency in neurodynamic testing is important
- Change the technique and you change the test
- Small changes in technique can produce BIG changes in the response

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# TECHNIQUE IS IMPORTANT!

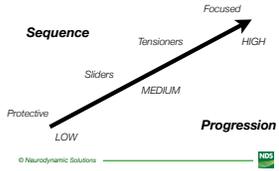
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## Neurodynamic Sequencing - progressions



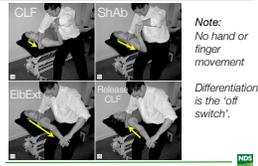
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## 1. Protective - remote sequence



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## 2. Sliders

The nerves slide toward the site where force (elongation) is initiated - 'down the tension gradient'



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## 2. Sliders



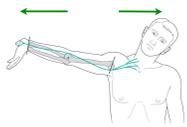
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## 3. Tensioners



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### 3. Tensioners



Neutral

Tension



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### 4. Focused Sequence - more Specific/ localised

Start at the relevant location

Wrist:

- Wrist extension
- elbow extension
- shoulder abduction
- lateral flexion



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### 4. Focused Sequence

Neck:

- Lateral flexion
- Shoulder abduction
- Elbow extension
- Wrist/finger extension



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### Physiology and Movement

Elongation

- elongation produces changes in blood vessel function
- 8% - intraneural veins start getting blocked
- 15% - all blood flow through nerve is blocked
- Lundborg and Rydevik (1973)



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### Physiology and Movement (cont.)

Compression

- 30-50 mmHg reduces venous flow from nerve
- Over one hour and the nerve fails (Gelberman et al 1983)
- Clinical pressures can reach 240 mmHg (Werner et al 1985)

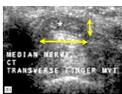


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### Physiology and Movement (cont.)

Normal nerve

Pressurized nerve



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Force

Time

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### Mechanosensitivity

How easily nerves are activated when subjected to mechanical force.

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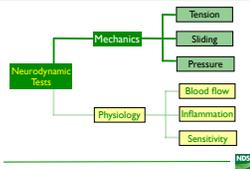
### Mechanosensitivity (cont.)

Is tested (evaluated) with:

- neurodynamic tests
- palpation
- passive movements
- active movements

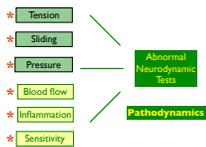
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### NEURODYNAMIC TESTS



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### Neuropathodynamics



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### Neurodynamic Test

Definition

A series of body movements that produces mechanical and physiological events in the nervous system according to the movements of the test.

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## Specific Neurodynamics

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### Specific Neurodynamics

#### Definition

Local effects of body movement on the nervous system in a way that is specific to each region

Eg. differences between dynamics of the median, ulnar and radial nerves

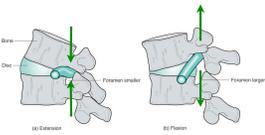
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### Mechanical interface - spinal canal



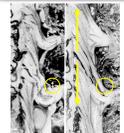
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### Intervertebral Foramen



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### Neural Tissues



- Extension  
- shorter and compressed
- Flexion  
- tissues longer and slide

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(Beilig 1978)

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### Clinical Uses of Flexion/Extension

#### Diagnosis of mechanical interface component

- reduced flexion - reduced opening dysfunction
- reduced extension - reduced closing dysfunction

#### Treatment is directed at the specific dysfunction:

- improve opening or closing, depending the problem

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### Lateral Flexion



Neural tissues on the convex side are tightened

Beig  
1978  
© 2007  
Neurodynamic Solutions



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### Application of Lateral Movements

#### Sensitizing movements

- contralateral lateral flexion
- contralateral lateral glide

#### Desensitizing (off-loading) movements

- ipsilateral lateral flexion
- ipsilateral lateral glide



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## Section 3

# *Nerve Palpation - upper quarter*

Practical/lab session

Median nerve at wrist and motor branch

Ulnar nerve at Guyon's canal and elbow

Radial sensory nerve in forearm

Brachial plexus:

- anterior shoulder
- costoclavicular space
- scalene triangle



# Nerve Palpation

## General Points

### Reasons for Use

Detect site of pathology or abnormal response

Establish whether anatomical changes are present in or around the nerve. This means:

### What Does Palpation Tell Us?

Where the problem is and how sensitive it is.

Whether the nerve or neighbouring tissues are inflamed or swollen or whether a pathology might exist.

### Normal Response

Nerves are normally mechanosensitive, given an adequate stimulus such as strong force. So palpation will elicit symptoms in some people and not others, depending on how sensitive that person's nerves are.

Possibilities:

- ▶ *no symptoms*
- ▶ *local discomfort*
- ▶ *sometimes referred symptoms but not usually for normal people*
- ▶ *this could be a subclinical abnormal response*

### Abnormal Response

Reproduction of symptoms, local or referred.

Different from other (asymptomatic) side or in a fashion that reflects the patient's problem

- ▶ *asymmetrical response - more tender on the symptomatic side*
- ▶ *thickening or swelling in or around the nerve*

### Technique

Large deep nerves - use either the pad of the thumb or index finger

Small superficial nerves - the back of the thumb nail or finger nail

Perform a 'catch-it-then-roll-of-it' action, like a guitar string.

Or: just apply pressure to the nerve and feel the tissues around also.

Deeper nerves - burrow to displace the overlying structures - GENTLY don't scrape around.

Test along the length of the nerve.

### What To Do

Palpate the following nerves and write down the following variables:

- ▶ *Size, shape and texture of the nerve (thickening?)*
- ▶ *Swelling in or around the nerve*
- ▶ *Flat nerve, round nerve?*
- ▶ *Where the tunnel structures are*
- ▶ *Can you feel the fascicles?*
- ▶ *Depth of the sulcus or surrounding tissues*
- ▶ *Sensitivity of the nerve – how hard to you have to push before symptoms develop*
- ▶ *Location of the symptoms – local or remote*
- ▶ *Extent of the physical signs ie. how far do they spread*
- ▶ *Kind of symptoms – ie. what do they feel like, pins and needles, numbness, aching or tenderness.*
- ▶ *Do a bilateral comparison*

You may have to palpate a great distance along the nerve

### Median nerve at the wrist

Between palmaris longus and flexor carpi radialis longus (FCRL)

Move the tendons aside and feel the nerve underneath.



### Ulnar nerve - Guyon's canal

Between the pisiform and the hook of the hamate.

Find it by rolling your thumb mediolaterally and vice versa.



### Radial sensory nerve in the forearm

On the lateral border of the radius between brachioradialis insertion and extensor carpi radialis longus (ECRL)

Resist elbow flexion in slight pronation to find them.

In between them is the nerve.



### Median nerve at the elbow

Find medial surface of biceps.

Move deeper to the medial border of brachialis.

Move medially and deep to find the nerve.



### Posterior interosseous nerve (radial nerve at the elbow)

Find lateral surface of biceps.

Move deeper to the lateral border of brachialis.

Move laterally and deep to find the nerve.

The nerve is typically flatter than the median nerve.



### Ulnar nerve at the elbow

Stand facing distally

Use your body and medial forearm to hold the patient's forearm.

Adjust the elbow flexion angle 30°-90° flex.

Palpate the nerve, sulcus and cubital tunnel with the side and tip of your thumb.



### Brachial plexus at the front of the shoulder

It passes long the line of the therapists' thumb as indicated.

Stand facing above the patients shoulder facing distally.

Use several fingers to pass over deltoid to the ribs. Then move along the line of the ribs upward and posteriorly.

You often can't usually feel the nerves but you can apply pressure along the course of the plexus.



### Upper trunk of the brachial plexus and the spinal nerves on the lateral side of the neck

Rotate the head away about 45°

Resist ipsilateral rotation to locate the anterior and middle scalenes

Follow them down to the clavicle and feel the nerve between them



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## Section 4

# *Upper Quarter Neurodynamic Tests*

Practical/lab Session

MNT1 - median neurodynamic test 1

UNT - ulnar neurodynamic test

MNT2 - median neurodynamic test 2

RNT - radial neurodynamic test



# Standard Neurodynamic Tests

## Standard Explanation Before All Neurodynamic Tests

To be done prior to the first neurodynamic test and repeated in short form with subsequent tests.

### Aims

- ▶ Reassure and relax the patient, reduce expectations
- ▶ Inform the patient about the manoeuvre
- ▶ Get the patient's permission
- ▶ Make the patient communicate effectively about their response
- ▶ Prevent them from compromising the technique

### Example

1. "If it's alright with you, I'd like to perform some movements on your arm.
1. This helps me evaluate the problem and may or may not produce some symptoms.
2. If you do feel anything, make sure that it does not go above mild to moderate (3-4/10).
3. It doesn't matter if you experience symptoms or not, but I need to know precisely what happens, as it happens.
4. So, without moving your body, please tell me verbally what happens.
5. Do you understand?
6. Now, are you comfortable and relaxed?"
7. Teach and practice the patient performing the contralateral lateral flexion

## Short Explanation for Subsequent Tests

"I'm going to do another test like the other one on your leg/arm/back, OK?". Just remember to ..... (discuss any previous problems only). OK?"

# Neurodynamic Testing Procedure

## Mental Movement Diagram:

1. Symptoms at rest
2. Change in symptoms during test
3. Change in resistance to movement during test
4. Adaptive movements - these can show abnormalities
5. End range of motion and reason for ceasing the movement
6. Location of symptoms
7. Effect of structural differentiation
8. After completion of the manoeuvre, the characteristics of the symptoms are discussed
9. Full details of the symptoms is obtained so as to determine the response category.

## Aims

- ▶ streamline diagnosis
- ▶ prevent provocation of symptoms by reducing the duration of the test

## Procedure

1. Is it permissible to perform the NDT on the SYMPTOMATIC SIDE FIRST. This can help reduce the patient's expectations and concerns that might be evoked by moving the less affected side first.
2. Perform neurodynamic test to point of onset of symptoms (P1) or resistance (somewhere between R1 and R2) or both. It is permissible to go further but this should be judged carefully and must be of value.
3. Ask "Where are your symptoms"
4. Based on the location of symptoms, decide which end of the test to move for structural differentiation (proximal or distal).
5. Perform structural differentiation to ascertain if the test is positive. Note that this does **not** describe whether it is abnormal at this stage.
6. Return to the neutral position.

7. Analyse the response (symptoms and physical behaviour) Adaptive Movements
  - ▶ If not enough information gained in the test used and an adaptive movement is observed, correction of the movement can be performed and the NDT is repeated
  - ▶ The effect of structural differentiation on the adaptive movement is assessed. If a change in the adaptive movement occurs, there is a positive link and this may later be considered relevant, depending on the relationship of these events to the patient's current clinical problem.
  - ▶ A positive effect of structural differentiation on the adaptive movement may indicate that the adaptive movement holds a neurodynamic component.
  - ▶ Bilateral comparison is performed in a similar fashion to the ipsilateral side
  - ▶ The adaptive movement can be used for reassessment
  - ▶ It can also be used in treatment in certain circumstances
  - ▶

## MNT1 - Median Neurodynamic Test 1

**Patient position** - supine, shoulder flush with the edge of the couch, as little abduction as possible, no pillow

Explanation to the patient

Practise lateral flexion

**Hand holds** - close hand sits on bed above the shoulder, using knuckles as a fulcrum. Lean on that hand with a straight elbow. Other hand holds patient's hand with a pistol grip



1. Starting position - arm down by side, elbow at 90°, neutral wrist position



Make your move: be slow and gentle

2. Glenohumeral abduction/external rotation - up to approx. 90-110° (in frontal plane, stop shoulder from elevating). DO NOT DEPRESS THE SCAPULA.



3. Supination of forearm/wrist and finger extension



4. Elbow extension - to point decided on prior to testing - assess the symptom response and physical behaviour through the movement



### 5. Structural differentiation - decided by where the symptoms occur

- Proximal symptoms - use the wrist
- Distal symptoms - use the neck



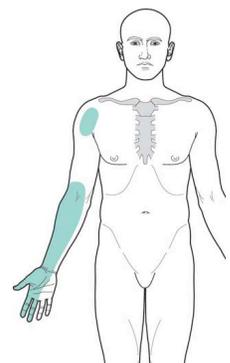
#### Notes on Structural Differentiation

- ▶ Only ask about **WHERE** the symptoms are
- ▶ Use this information to decide on and perform the structural differentiation manoeuvre
  - proximal symptoms - use distal movement
  - distal symptoms - use proximal movement
- ▶ Was the test positive? Remember this does **NOT** determine whether it is abnormal yet. It could be a *normal* positive test!
- ▶ Return to the rest position
- ▶ Do **NOT** ask about quality of the symptoms and other features during the manoeuvre. Wait until later.
- ▶ This helps to shorten the test
- ▶ When we do diagnosis later, we will analyse the symptoms in relation to the diagnostic categories
- ▶ You still make observations on range of motion, tissue resistance and adaptive movements etc.

#### Normal Response

**Symptoms** - pulling in the front of the elbow extending to the first three digits. Sometimes P+N in the hand in median nerve distribution. These change with neck side bending (Kenneally et al 1988).

**Range of movement** - anything between - 60°- full elbow extension (Pullos 1986, for review see Shacklock 2005).



### Common Problems With Technique

1. Performing scapular depression
2. Placing pressure over the front of the shoulder
3. Losing the following movements during performance of elbow extension:
  - ▶ shoulder abduction
  - ▶ supination
  - ▶ wrist extension

### Practical Application

**Remember** - before starting the following exercises:

Be slow and gentle, communicate and do not stay out there for too long.

This section is to develop your observational skills so you can perform a very sensitive examination.

#### 1. Using the MNT1 Document:

- a. The site and quality of symptoms
  - b. The result with structural differentiation
  - c. Using a movement diagram, document P1 and P2, R1 and R2, L and the behaviour of these parameters through the movement.
2. Describe any changes that you may have observed

## Supported MNT1 - Protective Technique



## UNT - Ulnar Neurodynamic Test

**Patient position** - supine, shoulder level with the edge of the couch, no pillow

**Therapist position and hand holds** - stride standing, facing toward the patient's head, your hip positioned against the couch, lean on it if you want, do a "low five" with the palm of your hand facing the palm of the patient's hand over the lateral aspect of your thigh, spread your fingers over the patient's, hold the weight of the limb with your supporting hand and thigh. Then put your knuckles on the bed like the MNT1, so that they are a fulcrum around which to do scapular depression.

1. **Starting position** - patient's arm straight and abducted as little as possible



2. **Shoulder depression** - taking up the slack in the nerves (not stretching). Assess the symptom response and physical behaviour through the movement



3. **Wrist and finger extension/pronation** - assess the symptom response and physical behaviour through the movement



**4. Elbow flexion** - assess the symptom response and physical behaviour through the movement.



**5. Glenohumeral external rotation** - assess the symptom response and physical behaviour through the movement. This is the tricky part. You will have to alter your position so you can walk around the patient's shoulder and your hand as the fulcrum, using your thigh to support the patient's arm.



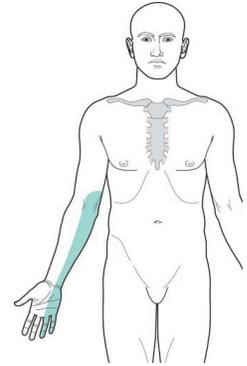
**6. Glenohumeral abduction** - assess the symptom response and physical behaviour through the movement. If at this point you get too much pulling in the hypothenar eminence, you can release the little finger to even out the test.



**7. Structural differentiation** - release a small amount of pressure from the scapular depression by flexing your wrist a small amount. At this point there should still be a fair amount of pressure through your knuckles on the bed.

## Normal Response

**Symptoms** - pulling in the medial elbow, sometimes extending into the forearm. Sometimes stretching in the ulnar border of the wrist and/or hypothenar eminence. The elbow and wrist symptoms usually change with releasing scapular depression.



**Range of movement** - anything between 20° to 55° abduction

See Flanagan (1993) for more on normal responses.

**Technique of lateral rotation.** The thigh is the support and the distal hand rotates the patient's arm around the patient's shoulder joint, in a rolling fashion. The therapist's front foot will have to be on tips toes to pivot adequately.



## Common Problems With Technique

- ▶ Too much shoulder abduction - revisit the scapular depression
- ▶ Not getting the rolling action of the humerus between the therapist's thigh and distal hand
- ▶ Pulling too hard on the patient's little finger producing severe pain in the hypothenar eminence - if so, release the patient's little finger A LITTLE. This often produces more proximal symptoms and enables testing of the neural tract to be more even.

## Using the UNT - Document:

- a. The site and quality of symptoms
- b. The result with structural differentiation
- c. The range at which you first feel resistance to movement of the elbow

- d. The range at which you first evoke symptoms
- e. The range at which you decide to stop moving and why you decided to stop. Remember that you do not need much resistance to put the nerve on significant tension.
- f. Using a movement diagram, document the relationships between behaviour of the resistance and symptoms through the range. Remember, be very gentle and do not stay on resistance for more than a few seconds.

## Experience the Neurodynamics

Find the ulnar and median nerves up the arm to the axilla

- change the elbow flexion/extension whilst feeling the median and ulnar nerves with the different techniques between the MNT1 and UNT. Keep moving sideways over the nerve to feel the tension change with the elbow movements.

- do structural differentiation with wrist flexion/extension without moving the elbow. Feel the changes in the nerves.



## MNT2 - Median Neurodynamic Test 2

**Patient position** - supine, shoulder over the side of the couch, no pillow

**Therapist position** - stride standing, facing toward the patient's feet, your hip positioned against top of shoulder, do not exert pressure yet.

**Hand holds** - lean over the patient's arm, your near hand supports the patient's elbow, other hand holds the patient's hand by hooking your thumb behind the patient's MCP joints., your fingers spread out over the patient's fingers on the palmar aspect.



**Hand hold during the MNT2.** The therapist's thumb passes behind the patient's MCP joints.

**Joint positions-** patient's arm down by side, elbow at 90°, neutral wrist position



**1. Shoulder depression** - taking up the slack in the nerves (not stretching). Assess the symptom response and physical behaviour through the movement

**2. Elbow extension** - assess the symptom response and physical behaviour through the movement



**3. External rotation/supination** - (to available range horizontal if very mobile). Assess the symptom response and physical behaviour through the movement



**4. Wrist & finger extension** - assess the symptom response and physical behaviour through the movement.



**5. Shoulder abduction** - if need be. Assess the symptom response and physical behaviour through the movement



**6. Structural differentiation** - Release a small amount of pressure from the scapular depression

- *Proximal symptoms* - use the wrist
- *Distal symptoms* - use the scapula

### Normal Response

Symptoms: pulling in the front of the elbow extending to the first three digits. Sometimes P+N in the hand in median nerve distribution. These change with release of scapular depression or neck lateral flexion.

Range of movement - anything between 0° to 45° abduction

### Common Problems with Technique

- ▶ Placing the far leg forward instead of the near leg
- ▶ Pulling too hard on scapular depression. It should be gentle taking up the slack in the muscles and nerves.
- ▶ Not leaning far enough distally so that the patient's hand movements are not "pulled on". Otherwise the hand goes into radial deviation and the thenar eminence gets pulled on.

### Practical

Using the MNT2, Document:

- a. The site and quality of symptoms
- b. The result with structural differentiation
- c. The range of shoulder abduction at which you first evoke symptoms. If you encounter symptoms before then, release some scapular depression and then observe the shoulder abduction.

- d. The range at which you decide to stop moving and why you decided to stop. Remember that you do not need much resistance to put the nerve on significant tension.
- e. Using a movement diagram, document the relationships between behaviour of the resistance and symptoms through the range. Remember, be very gentle and do not stay on resistance for more than a few seconds.

## RNT - Radial Neurodynamic Test

**Patient position** - supine, shoulder level over the edge of the couch, no pillow

**Therapist position** - stride standing, facing toward the patient's feet, your hip positioned against top of shoulder, do not exert pressure yet

**Hand holds** - lean over the patient's arm (swap hands from the MNT 2 med. nerve), your far hand supports the patient's elbow, the other hand covers the back of the hand and fingers.

**Joint position** - patient's arm down by side, elbow at 90°, neutral wrist and finger position

1. **Shoulder depression** - taking up the slack in the nerves (not stretching). Assess the symptom response and physical behaviour through the movement



2. **Elbow extension** - assess the symptom response and physical behaviour through the movement



**3. Internal rotation/pronation** - assess the symptom response and physical behaviour through the movement



**4. Wrist & finger flexion** - assess the symptom response and physical behaviour through the movement.



**5. Shoulder abduction** - if need be. Assess the symptom response and physical behaviour through the movement



**6. Structural differentiation**

- Distal symptoms - release scapular depression a small amount
- Proximal symptoms - release wrist flexion

### Normal Response

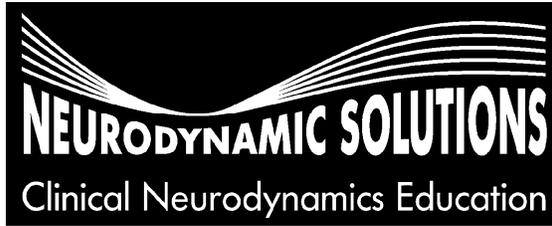
Symptoms: pulling in the lateral elbow extending into the forearm. Sometimes stretching in the back of the wrist occurs. The elbow symptoms usually change with releasing scapular depression and the wrist symptoms sometimes change with releasing scapular depression.

Range of movement - anything between 0° to 45° abduction

See Yaxley & Jull (1991, 1993) for normal responses and those in lateral tennis elbow.

### Common Problems with Technique

- ▶ not using the near hand for the distal grip
- ▶ losing the elbow extension



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Helping clinicians help their patients

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NEURODYNAMIC SOLUTIONS (NDS)

Clinical neurodynamics course

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## About Neurodynamic Solutions (NDS)

### Background

Neurodynamic Solutions (NDS) is the teaching entity founded by Michael Shacklock. It was started with the express purpose of offering practical clinical solutions for therapists with an interest in neuromusculoskeletal problems. The emphasis is on clinical neurodynamics for neuromusculoskeletal problems in a way which clarifies and demystifies neurodynamics and makes the subject as clinically applied as possible.

### Objectives

Offer practical clinical solutions for therapists who treat patients with musculoskeletal problems with a neural component  
 Include the most up-to-date research and clinical information  
 Offer a systematic method of application of neurodynamics  
 Foster further development in clinical neurodynamics

### Resources

Free registration  
 Web site - [neurodynamicsolutions.com](http://neurodynamicsolutions.com)  
 Courses - upper and lower quarters  
 Newsletters - clinical solutions, new updates in research, conferences announcements, books and other resources, web links - other medical, physiotherapy and educational groups, search engines and physical therapy data bases

### Course Manual

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### NEURODYNAMIC SOLUTIONS (NDS) COURSES



Courses in clinical neurodynamics as presented in Michael Shacklock's book are available worldwide. If you are interested in hosting or attending a workshop, seminar or conference event in neurodynamics do contact

Neurodynamic Solutions (NDS).

#### CONTACT:

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## About Michael Shacklock



Michael Shacklock graduated as a physiotherapist from the Auckland School of Health Sciences in 1980. During his undergraduate training, he quickly developed an interest in manual therapy and has pursued this interest throughout his career. He worked in public hospitals and private practices for several years in New Zealand before traveling to Adelaide, South Australia in 1985, to take part in post-graduate study. In 1989, he completed a Graduate Diploma in Advanced Manipulative Therapy at the University of South Australia and converted this to a Master of Applied Science in 1993. He has taught internationally for over 15 years and has given numerous keynote and invited presentations throughout the western world. His Masters thesis was on the effect of order of movement on the peroneal neurodynamic test, in which he discovered the concept of neurodynamic sequencing.

Since then he has studied mechanics and physiology of the nervous system, performing research and writing a number of publications on the subject. Michael edited the extremely successful book *Moving in on Pain* and has published in *Physiotherapy* and *Manual Therapy* and written leading and invited articles for the *Australian Journal of Physiotherapy* and *New Zealand Journal of Physiotherapy*. Michael's most recent publications consist of his new book on clinical neurodynamics, for which he received a Fellow of the Australian College of Physiotherapists by original contribution by monograph. He is written an editorial for *Manual Therapy* on critical issues in research and clinical application of neurodynamic and neural tension testing and treatments and an overview paper on clinical neurodynamics for *Manuelle Therapie*, in German. His most recent publication is the book, *Biomechanics of the Nervous System: Breig revisited*.

Michael's recent area of investigation has been the *in vivo* imaging of mechanical function of the nervous system and cadaver observations of lumbosacral nerve root movement. He teaches Clinical Neurodynamics internationally. Michael Shacklock's current positions are founding director of Neurodynamic Solutions (NDS). He is a member of the International Advisory Board for *Manual Therapy*. He is also a reviewer for the international peer-reviewed journals *Manual Therapy*, and the Physiotherapy Research Foundation.

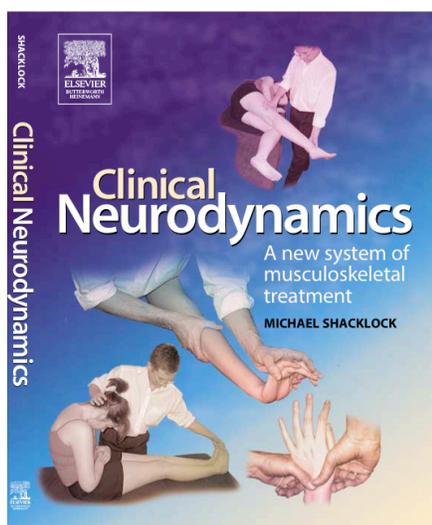
## About Marinko Rade



Born in Ljubljana (Slovenia) in 1982, Marinko Rade lived in Rovinj (Croatia) until the completion of High School. He studied in Padova (Italy) and London (UK), receiving a Master of Science in Orthopaedic Medicine. He is currently a doctoral candidate at the Graduate School of Clinical Research at University of Eastern Finland and is employed as a clinical researcher for the department of Physical and Rehabilitation Medicine in Kuopio University Hospital, Finland. His special research interest is the quantification and understanding of neural adaptation mechanisms with the final aim of constructing new effective diagnostic algorithms. He is leading several lines of research both in

electrophysiology and neuroradiology. Marinko is a voting member of the International Academy for Musculoskeletal Medicine and scientific branch of the International Federation for Manual Musculoskeletal Medicine. He was awarded the 2013 Young Scientist of the Year by the Finnish Spine Society. Marinko has published research articles in journals such as the *Journal of Electromyography* and *Kinesiology and Spine*. Marinko has also been a lead instructor with NDS Neurodynamic Solutions since 2010. He is now leading the Orthopaedic and Rehabilitation Hospital "Prim.dr.Martin Horvat" in Rovinj, Croatia.

## Clinical Neurodynamics Book



After much study and investigation over the last 10 years, Michael Shacklock's book is about a new system of musculoskeletal treatment for patients whose musculoskeletal problem has a neural component. The book takes the therapist from neural tension to neurodynamics. Key problems with neural tension treatments in the past have been the risk of provocation of symptoms, the method of diagnosis and treatment has been unclear and there has not been a systematic and methodical approach to diagnosis and selection and progression of treatment techniques.

In this international best-seller, Michael demystifies how the nervous system moves and can cause problems, provides a new systematic approach to prevent provocation of symptoms yet still provide a beneficial effect and how to select advanced techniques ranging from those for the very restricted patient to the athlete.

### Key Features

- *new diagnostic and treatment techniques*
- *over 200 diagrams and illustrations of techniques*
- *new movement diagram to help the clinician link musculoskeletal and neural functions*
- *new system for technique progression from restricted to highly mobile patients*
- *a method of integrating neural and musculoskeletal techniques in diagnosis and treatment*
- *CD-ROM of nerves and musculoskeletal tissues moving in real time to illustrate normal and abnormal situations and the importance of the interdependence of the musculoskeletal and neural systems*

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## Neurodynamics Course Aims

Improve/develop:

- **manual skills**, specifically the ability to **feel abnormalities in movement** related to the nervous system in the lower quarter
- abilities in **diagnosis** and **interpretation** of lower quarter neurodynamic testing and **musculoskeletal relationships**
- clinician's **repertoire** of **diagnosis** and **treatment** of techniques
- **safety** in relation to clinical neurodynamics

### Please Note

Participants are responsible for their own well being on this course. It is recommended that participants decline to have any manoeuvres performed on them if the participant may react with undue pain or suffering, have a condition which might influence their ability to tolerate any manoeuvres or predispose to the development of subsequent pain or suffering.

Participants are under no obligation to have a manoeuvre performed on them and may freely decline.

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## Section 2

# *Cornerstones in Neurodynamics*

Audiovisual Presentation

