Section 6

Nerve Palpation - lower quarter

Practical/lab session

Sciatic

Tibial - tarsal tunnel, medial calcaneal

Fibular (peroneal) - common, superficial, deep

Sural

NEURODYNAMIC SOLUTIONS

Clinical Neurodynamics Education

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

Sciatic nerve in the buttock

Posterior aspect of greater trochanter

Lateral aspect of ischial tuberosity.

In between these two structures, find the groove.

Follow the nerve into the thigh.

Sciatic nerve with the hamstrings

Following the nerve into the thigh, you can add knee extension, dorsiflexion or spinal flexion.

Tibial nerve blqehind the knee

De-rotate the limb to the neutral position to place the access point for the nerve in the centre of the limb

Nerve is in the middle between the two dimples behind the knee.

Peroneal nerve at the knee

Place knee in 90 flexion.

Find head of fibula.

Nerve runs horizontally along the neck of the fibula.

Follow it around the neck of the fibula and move your finger up and down.

Tunnel for the superficial peroneal nerve

If necessary, position ankle in a small amount of plantarflexion/inversion to take the slack out of the nerve.

Follow the nerve up to its tunnel, where there is a soft spot which indicates the tunnel.

The nerve often has medial and lateral branches and can anastomose with the sural nerve.

Superficial peroneal nerve over the ankle

You can 'twang' the nerve like a guitar string and palpate along its course.

Sensory nerve that supplies most of the dorsum of the foot, but NOT the skin between the first and second toes.

Deep peroneal nerve at the ankle to its terminal in between the first and second toes

Between extensor hallucis and digitorum tendons over the dorsum of the ankle.

Follow it along the dorsum of the foot to the lateral aspect of the first metatarsal.

Sural nerve at the ankle

With your fingers, provide counter pressure on the medial aspect of the Achilles tendon.

Gently roll your thumb over the nerve.

If you can't feel it you can add some dorsiflexion/inversion and/or straight leg raise.

Tibial nerve at the ankle

Located medially between the medial malleolus and the calcaneum.

Look for swelling in medial aspect of both ankles over the tarsal tunnel.

Section 7

Lower Quarter Neurodynamic Tests

Practical/lab session

Straight leg raise
Slump test (unilateral and bilateral)
Prone knee bend
Tibial
Peroneal
Sural

NEURODYNAMIC SOLUTIONS
Clinical Neurodynamics Education

Straight Leg Raise

Introduction

The straight leg raise is used to test the movement and mechanical sensitivity of the lumbosacral neural structures and their distal extensions which consist of the lumbosacral trunk and plexus in the pelvis, sciatic and tibial nerves and their distal extensions in the leg and foot.

Indications

Lower quarter problems - pathology, dysfunction, pain

Thoracic spine problems

Occasionally cervical disorders and headache

Preparation

Patient position - supine, aligned symmetrically, in purest form - no pillow under the patient's head for reasons of consistency.

Therapist position - stride standing so that the therapist can alter their position and maintain good technique at the same time.

Movements

Hip flexion with a straight knee.

Prevent any variation of movements in the frontal and transverse planes, namely adduction/abduction and internal and external rotation of the hip. This is because all these movements sensitize the test

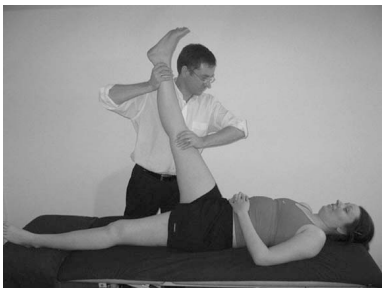
Technique

The therapist's distal hand gently clasps the posterior aspect of the leg, immediately proximal to the ankle. The reason for choosing this position is that patients often experience ankle discomfort if the calcaneum is used at the contact point. This is because, as the limb is raised, its weight pushes the tibia posteriorly on the talus which turns the test into an anterior draw for talocrucal instability and can be uncomfortable in even normal subjects, especially if the ankle is relaxed and hypermobile.

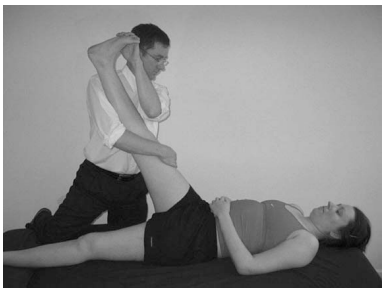
The therapist's proximal hand is then placed over the anterior aspect of the knee, either immediately distal to the patella over the tibial plateau, or immediately proximal to the patella over the distal insertion of the quadriceps tendon. These hand positions are chosen to avoid patellofemoral compression and subsequent discomfort.

The limb is gently raised and the symptoms and physical responses are monitored closely. During the actual movement, it is crucial that the therapist prevent any knee flexion because small changes in knee position will produce significant changes in the response and range of motion. Movements of the hip in the transverse and frontal planes are also controlled precisely.

Straight leg raise



Dorsiflexion



Sensitising Movements (level 3A)

Internal rotation and adduction of the hip

Dorsiflexion, dorsiflexion/eversion (tibial nerve bias), dorsiflexion/inversion (sural nerve bias) and plantarflexion/inversion (peroneal nerve bias).

Contralateral lateral flexion of the spine.

Internal rotation/adduction of the hip

Structural Differentiation

Proximal symptoms – use dorsiflexion, a change in grip and body position are necessary.

Distal symptoms – they are probably already differentiated hip flexion producing distal symptoms.

ACTIVE CERVICAL FLEXION

Structural differentiation of the straight leg raise is often attempted by the therapist asking the patient to perform active neck flexion. Unfortunately, this is entirely flawed and can produce a wide variety of false results. The inadequacy of this method is by virtue of the abdominal muscles contracting during the head raise, causing the pelvis to rotate posteriorly. This reduces the hip flexion angle and often reduces the symptoms because of a lowering of the straight leg raise by the mechanism of reversed origin. Conversely, some patients activate their hip flexors which produces an increase in straight leg raise angle by rotating the pelvis anteriorly. On account of the above, active neck flexion in the differentiation of the straight leg raise test is not recommended.

Common Problems with Technique

Not holding the knee in full extension - note that the technique of holding the knee does not force the knee into extension.

Not controlling movements of the hip in the transverse and frontal planes – this produces alterations in sensitisation of the test.

Not being able to make the transition from the beginning of the straight leg raise to the end in which the therapist's standing position changes at the middle part of the test. This will necessitate the therapist paying particular attention to altering the weight on their feet and direction of their own body smoothly. Practising this

aspect of the technique on people of different sizes and shapes solves this problem.

Stopping hip flexion at the first movement of the pelvis – this has been a popular technique in structural differentiation. The idea is that if the pelvis has not moved, neither has the lumbar spine. Therefore, if low back pain is reproduced, the problem must have a neural aspect to it. Even though the logic for the use of this approach is reasonable, it houses problems. Since the hip flexion angle never reaches full range, the neural structures are also not moved through their full range. This procedure will therefore be prone to producing false negatives.

Normal response

Pulling and stretching in the posterior thigh that spreads into the posterior knee and sometimes into the upper third of the calf. The range of motion varies between approximately 50°-100°°.

Tibial Neurodynamic Test (TNT)

Indications

When symptoms are located in the distribution of the tibial nerve and its extensions ie. posterior tibial neve, medial calcaneal nerve, and the plantar and digital nerves.

Calf pain, heel pain (including plantar fasciitis) and pain in the plantar aspect of the foot,

Preparation

Distal hand hold

Starting position

Technique

1. Dorsiflexion/eversion - executed at the foot
2. Straight leg raise second - lean backwards over your back foot

The therapist straightens their body and uses their distal arm to produce the movement.

Generally, little movement of the therapist's hands should occur on the patient's skin. If undue slipping occurs, it will be necessary to modify the technique to prevent this.

The distal hand should have a good hold on the foot so that this hand can initiate and control the straight leg raise movement.

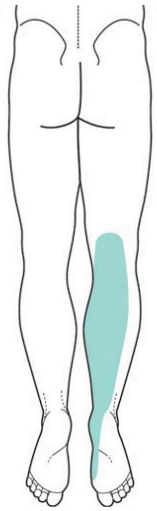
Common Problems With Technique

Not standing with the legs far enough apart - crowding the therapist out

Not holding the patient's foot correctly – the foot hold is actually quite difficult because much of the limb's weight is carried through this hand. Hence, it is worthwhile practising the grip so that it is both comfortable for the patient and clinically effective.

Not holding the knee in extension properly – with the difficulty of holding the foot, it is common for therapists to release the knee extension, simply due loss of concentration.

Normal Response



Stretching in the calf region (sometimes medial calf) and this often extends into the medial aspect of the ankle and plantar surface of the foot.

ROM - straight leg raise is usually between 30° and 70°. When performed effectively, the leg can not be raised as far as the standard straight leg raise test in the same individual.

Peroneal Neurodynamic Test (PNT)

Indications

Conditions that affect the anterolateral leg and ankle and dorsal foot areas.

The therapist should also be willing to test use this test in the presence of L4-5 radicular pain because, occasionally, it can be more sensitive for this problem than the standard straight leg raise with dorsiflexion.

Preparation

Therapist position - stride standing, facing and leaning caudad.

The therapist's far hand passes under the plantar aspect of the foot so that, by the time plantarflexion/inversion has occurred, the fingers can come over the top of the toes, after passing distally and wrapping back over their dorsal surface. This is important because movement of the toes (target tissue) is an important part of the test and is often omitted. Executing this part of the technique properly will give the therapist the opportunity to take the nerve to its end range of motion and will necessitate that the therapist cradles the patient's achilles tendon and ankle regions on the therapist's forearm.

Place the near (proximal) hand over the anterior aspect of the proximal end of the tibial plateau and grasp it firmly but comfortably. The job of this hand is to maintain the knee in extension

Prevent internal rotation of the tibia during the plantarflexion/inversion movement so that the patient's hip does not rotate extraneously.

Starting position for the peroneal neurodynamic test (PNT).

Movements

Plantarflexion/inversion of the ankle foot, and toes, followed by the straight leg raise.

Technique

The leg raise component movement is performed by the therapist's distal arm, such that the main weight-bearing surface is the therapist's distal forearm. This means that the therapist will have to transfer their weight from their front (distal) foot toward their back (proximal) foot so that the movement hinges around the patient's hip joint during the straight leg raise movement.

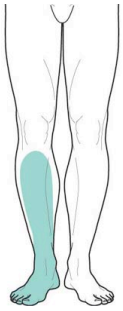
Common Problems With Technique

Not holding the foot correctly – in this case, the movements of the foot will be insufficient in amplitude or they may deviate into either too much plantarflexion relative to the inversion.

Not using the distal forearm to produce the straight leg raise (hip flexion) component – this will make it difficult to raise the leg without losing control of the foot movements.

Not fixating the tibia on the femur – this results in internal rotation of the entire lower limb, which, although may be used to sensitise the test, is an extraneous movement in relation to the standard one.

Normal Response



Stretching/pulling in the anterolateral leg, ankle and foot. When it does not extend the whole length of this area, it can occupy patches that are within the distribution of the peroneal nerve.

Sensitising Movements

- contralateral lateral flexion
- slump test
- internal rotation and adduction of the hip joint

Sural Neurodynamic Test (SNT)

Indications

When symptoms appear in the posterolateral leg, ankle and foot eg. sprained ankle, S1 radiculopathy, cuboid syndrome and peroneal tendonitis.

Preparation

The hand hold is the opposite to the peroneal neurodynamic test

Distal hand passes medially around the foot.

Proximal hand passes medially around tibia and knee.

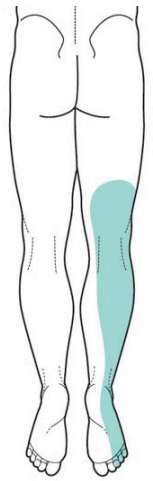
Dorsiflexion/inversion + straight leg raise

Common Problems With Technique

Not holding the knee properly – this enables the knee to straighten slightly, which compromises the sequence of movements and reduces the effectiveness of the test.

Not moving around the patient's hip joint – this means that the limb will tend to abduct and, again, the effectiveness of the test is reduced. To correct this, it is essential to start from the point of standing with the legs wide apart, leaning around the patient and being prepared to transfer weight from foot to foot.

Normal Response



Pulling/stretch in the lateral ankle region and sometimes this spreads into the posterolateral aspect of the calf.

SLR ROM - 30°-60°

Sensitising Movements

- contralateral lateral flexion of the lumbar spine
- slump test
- internal rotation and adduction of the hip joint

Slump Test

Introduction

The Slump test is used to evaluate the dynamics of the neural structures of the central and peripheral nervous systems from the head, along the spinal cord and sciatic nerve tract and its extensions, in the foot. It is a complex test and is often misunderstood and misinterpreted. In the past, the general technique has been to lower the head and straighten the leg whilst the patient is in the sitting position. If the patient's pain is reproduce, the test is abnormal. The problem with this is that it does not take into account subtleties that should be applied in order to gain the most from the test and offer the patient an accurate diagnosis. By this, it is meant that sensitive with attention to detail in both technique and interpretation is crucial in effective application of the test.

Indications

Technically, any symptom from the head to the foot that lies in the distribution of the brain and spinal cord could warrant evaluation with the slump test.

Common conditions - headache, pain anywhere in the spine or shoulder girdle, pelvic problems

Lower limb problems in which the pain is located in the distribution of the sciatic nerve and its extensions.

Preparation

Patient position

- sitting with the posterior aspect of their knees against the edge of the treatment couch with their thighs parallel.
- patient's knees against the edge of the couch

Therapist position

Both feet on the ground, leaning toward the patient's shoulders, proximal arm over the patient's shoulders ready to guide the patient's upper body and neck movements

Movements

1. Thoracic and lumbar flexion (slump component)

This is the bow string effect between C7 and hip joints. It is not compression, even though some occurs.

Check that the sacrum is vertical at the end of this manoeuvre for consistency reasons.

Apply over pressure - if appropriate

2. Cervical Flexion

The patient slowly lowers their head toward their chest. So that provocation of symptoms is avoided, the therapist places their far hand on the patient's forehead and controls the speed and amplitude of neck flexion.

The range of motion (determined by prior clinical reasoning) is maintained by the therapist changing their hand position so that the palm of the near hand rests gently on the patient's occiput.

The hand that controlled the cervical flexion (far hand) is freed to deal with the lower limbs.

The action of the hand that lies over the patient's occiput is one of preventing release of cervical flexion rather than applying overpressure into flexion.

Usually, sufficient information can be obtained without performing overpressure. For this reason, overpressure to cervical flexion should not be part of the standard slump test.

However, gentle overpressure into cervical flexion can be a very useful addition to standard testing, as in more extensive examination. Its benefit is in the detection of subtle abnormalities and is a key part in diagnosis of the covert abnormal response. In patient's who have such an abnormality, the neck shows greater tightness than usual or the therapist can feel the head trying to elevate in an attempt to release cervical flexion.

3. Knee extension

Active or passive - at the therapist's discretion and will vary between patients.

I suggest a combination of both. In the end, the imperative is for the therapist to have a good understanding of the relationships between each dimension.

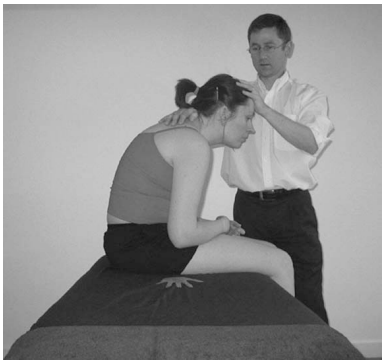
In the performance of knee extension, the therapist holds the patient's ankle, which is the easy part. The difficult part of this manoeuvre is to hold the rest of the patient's body still so that extraneous movements do not occur. This necessitates the therapist holding their near hand and medial forearm on the patient's occiput and C7 spinous process precisely in the same position throughout the latter stages of the test

4. Dorsiflexion

Uses - finalise the slump test, differentiate lumbar symptoms

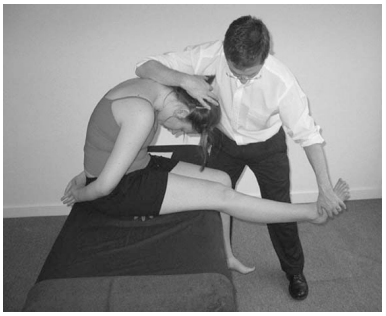
Method - hold the foot with the whole of the therapist's distal hand and make the movement.

Thoracic and lumbar flexion

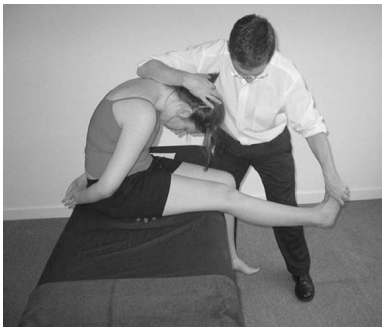


Neck flexion

Knee extension



Dorsiflexion



5. Release Neck Flexion

The patient can also have their hands behind their back, resting on the bed.

Level 3a - Neurodynamically Sensitised Slump Test

The complete level 3 (sensitised) slump test consists of the standard slump test and the additional sensitising movements which are as follows.

Contralateral lateral flexion

Full level/type 3a slump test

Level/type 3a long

sitting slump test

Section 8

Diagnosis with Neurodynamic Tests

Lecture and practical/lab session

Classification of responses

Interpretation of neurodynamic tests

Practise testing

Diagnosis with Neurodynamic Tests

Interpretation of Neurodynamic Tests

Potential Sources of symptoms

- Axons in the nerve
- Connective tissues in the nerve (nervi nervorum)
- Blood vessels in or around the nerve
- Muscles
- Joints
- Fascia

Therefore structural differentiation manoeuvres are essential

Structural Differentiation

The first distinction to make is whether the nervous system is involved because it affects the next chain of events with the way we reason through the examination and treatment.

Structural differentiation is used to make a distinction between neural and non-neural structures and is an essential part of neurodynamic testing. As a reminder, it is when the nerves in the problem area are moved without moving the musculoskeletal tissues. Therefore, if the symptoms change with the differentiating manoeuvre, the symptoms are inferred to be neurogenic. In the non-neural response, the symptoms do not change with the differentiating movement. The validity of structural differentiation has not been definitively proven but there is good evidence that, in some cases, it is a valid way of testing nerves.

Here is an example of structural differentiation:

eg. Forearm symptoms with the MNT1. Neural or musculoskeletal?

Change the tension in the nerves with side bending of the neck and, if the symptoms also change, the symptoms are likely to be neural. If they do not, then they are likely to be non-neural (ie. from muscles, joint or fascia). To differentiate symptoms in the neck or shoulder, you would use wrist movements.

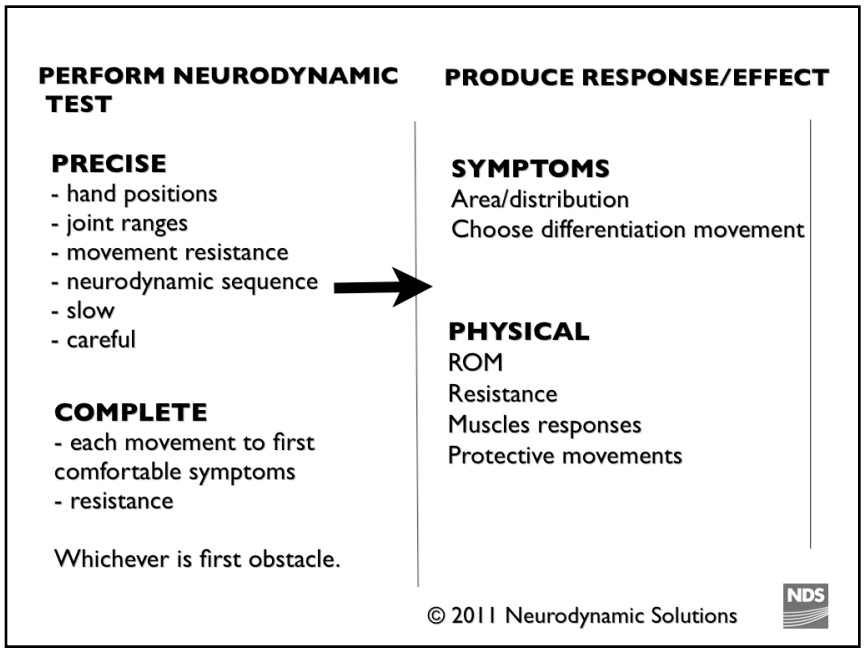
The next section on classification of responses challenges some of our old concepts of positivity.

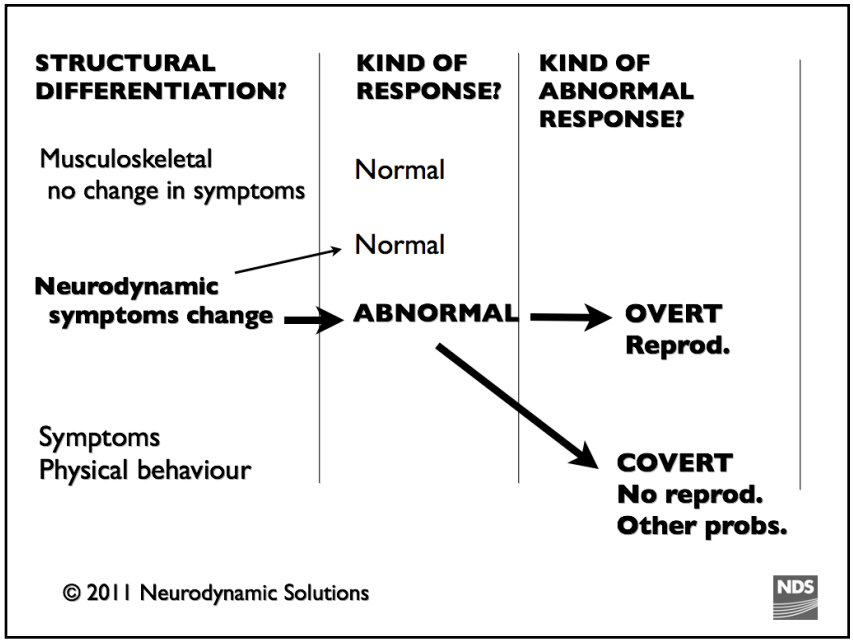
Classification of Responses

Problems exist with the classification of symptoms responses with neurodynamic tests because of the many possible types of responses that can

occur and what each means. Here is a suggested classification of responses and a distinction between them must be made for clinical interventions to be well-founded.

Diagnostic/Clinical Pathway





RELEVANT?

NO
Does not relate to problem → Symptoms - wrong area

Historically DO NOT relate to current problem

YES Relates to problem → Symptoms - correct area

Historically - DO relate to current problem

CAUSE

Complete Evaluation

Diagnostic Category

- red flags
- muscle
- disc
- joint
- neuropathy
- interface
- tension
- sliding

TREATMENT?

Elimination of contraindications → NO

Is this my professional territory? → **YES**

TECHNIQUE SELECTION

Diagnostic Category

Level/type of the patient:

1
2
3a, b, c, d, e

PROGRESSIONS

Musculoskeletal Response

A musculoskeletal response does not change when a differentiating movement is performed. Neurodynamic tests can produce this kind of response. In which case the neural tissues are not likely to be the source of symptoms.

Normal Neural Responses

The ULNTs are very sensitive tests because the are neurogenic in normal subjects (Kenneally et al 1988). So here are some crucial questions.

Q: What does a positive test mean if they are positive in normals?

A: It is normal for test to produce a neurogenic response. Therefore, we must now distinguish between normal neurogenic and abnormal neurogenic responses in our patients.

Are differentiated to be neural

Are similar in location and range of movement and quality of symptoms to those in normal subjects

Reasonably symmetrical in site and quality of symptoms

Reasonably symmetrical in range of motion and behaviour of resistance

Does not reproduce the clinical symptoms

Abnormal Neurogenic Responses (neuropathic)

Are differentiated to be neural with structural differentiation

Are different from those in normal subjects

Show reduced range of movement compared with the unaffected side

Show increased resistance compared with the unaffected side

The location or quality of symptoms can be different from normal or unaffected side

A. Overt Abnormal Response

Structural differentiation gives a neural result.

The test reproduces the patient's symptoms

The range of motion may be reduced.

B. Covert Abnormal Response

Is differentiated to be neural

Evokes abnormal symptoms but it:

Does not reproduce the patient's clinical pain

May be asymmetrical in range, resistance pattern or distribution of symptoms

May be a "comparable sign" worth treating.

The most important thing is to determine the relevance of the response. In the symptomatic patient, it could be a subtle problem that needs treatment.

Or, in the asymptomatic person, the response could be a hidden subclinical abnormality, or even a variation on normal for that individual. Matching this response with the patient problem is a key aspect of interpreting responses to neurodynamic tests.

eg. a patient complains of forearm pain when working with computers. A cramping ache is evoked by the MNT1 in the region of the problem but it is not the sharp pain like it is with using a computer. The clinical pain is not reproduced but something abnormal is evoked. It is differentiated to be neural with neck contralateral lateral flexion and the range of elbow extension is reduced by several degrees compared with the normal side. The supination component of the test is tight compared with the other side, and this loosens with releasing neck contralateral lateral flexion. These physical signs could be relevant and to miss them would leave the patient without the option of potentially effective treatment.

What Is a Positive Test and What Does It Mean?

Get away from using the term positive because tests are neurogenic (positive) in normal subjects. The NDTs are sometimes so sensitive that an ordinary neurogenic response does not necessarily indicate an abnormality. So I suggest that you do not use the term "positive".

Use the terms - "normal neurogenic" or "abnormal neurogenic" (neuropathic) and then categorise what type of abnormal neurogenic response it is.

An abnormal neurogenic test does not tell you what exactly is wrong. For more discussion see (Shacklock 1996).

Practical Application - exercises in diagnosis

Tasks:

Classify the category of response in your partner(s) for the MNT1, RNT and/or MNT2 and UNT.

Remember all the details with physical examination that you practised earlier. eg. patient position, hand holds, land marks, slow and gentle, feel for resistance to movement, communicate about where the symptoms are, do structural differentiation etc.

Please do NOT obtain a history from your colleague prior to testing. However, naturally, they are free to decline from being a subject for testing for any reason.

Do the test slowly and gently.

AIM: see if you can identify a neurodynamic abnormality without prior knowledge of your colleague's history.

In the event that you find an abnormality, you may be interested in taking a brief history to understand the significance of the subject's response.

Analysis of Test Responses

Once you have decided that the testis positive (to structural differentiation), do the following:

Are those the symptoms you have had before (or partly)?
"YES" - overt abnormal response
"NO" perform stage 2.

Is the response similar to the known normal response?
Are the:
- ranges of motion and tissue resistance normal?
- location and distribution, type of symptoms (stretch etc) normal?

"YES" - normal positive test
"NO" - covert abnormal response (tighter than normal, range of motion reduced, symptoms spread outside the normal area)**.**

1. Not sure - compare with contralateral side.

   NOTE: Any variable used in classifying the response must be positive to structural differentiation.

2. Is it Relevant?
   You can have any type of response (overt, covert, normal) being relevant or irrelevant and this depends on how it relates to the patient's current problem.

   Relevant
   - reproduces the patient's current clinical pain - overt abnormal
   - is tighter r than normal
   - the symptoms spread further than normal
   - this is different from the asymptomatic side
   - the difference is in the right location for the patient problem

Irrelevant
- relates to an old problem that is no longer symptomatic
- anomalous response that is symmetrical eg. bilateral tightness
- normally tight for that person and is symmetrical
- may have an anatomical anomaly that is not relevant

It is possible that not all nerve problems hurt (Neary et al 1975).

Relationship of NDTs to the Cause

An abnormal neurodynamic test does not establish the cause. This is ascertained in the entirety of the evaluation process and involves subjective and physical examinations, medical and radiological tests etc.

Therefore, the main thing that an abnormal neurodynamic test offers is that fact that something in the nervous system is wrong and the cause must be established.

Possible causes of an abnormal neurodynamic test:
- Pancoast tumour and malignancies
- osteophytes
- disc bulges
- swollen joints and tendon sheaths
- ganglia
- myotendinous and nervous system anomalies
- neuritis
- nerve compression
- joint movement dysfunctions.

Therefore it is imperative that NDTs are only used as an indicator that something is wrong.

An abnormal neurodynamic test means that the neural tissues may be mechanosensitive or contain movement impairment for which the cause must be established.

Section 9

Planning Examination and Treatment

Lecture

System of technique selection

Should I do a neurological examination?

NEURODYNAMIC SOLUTIONS

Clinical Neurodynamics Education

Planning Examination and Treatment

How extensive should it be?

General Points

Confusion exists about how to select examination and treatment techniques

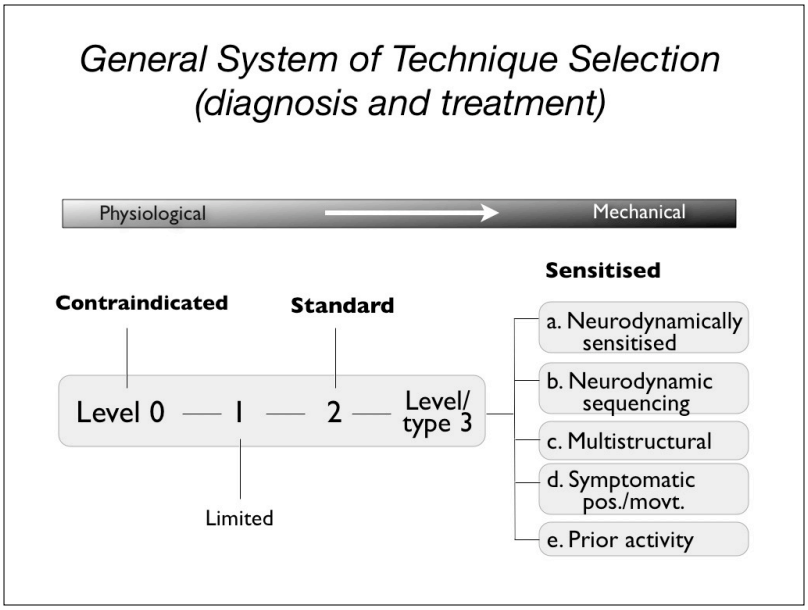
- *how strongly should a neurodynamic test be performed?*
- *how far into a provoking movement should a test be taken?*

There is a spectrum of patient problems ranging from the very sensitive to the athletic which systematic treatment can take into account

- *which neurodynamic sequence should be used?*
- *sliding versus tension treatments*
- *interface versus neural treatments*
- *standard tests in evaluation/treatment or limited or extensive/sensitised techniques*

Decisions on the extent and type of examination are influenced by many clinical factors that need clarification.

Below is a three tier system of deciding on the extent of the examination in the planning of neurodynamic testing. Naturally, not all criteria will occur simultaneously in the same patient and it is the role of the practitioner to choose the most appropriate elements in deciding on the extent of the examination.



Level Zero – Neurodynamic Testing Contraindicated

Severe pain
Psychological influences
Legal problems
Highly unstable condition, worsening rapidly and other priorities take precedence

Level 1 - Limited

Description

This level of examination is designed to open new and safer avenues for assessment and treatment in the patient with irritable symptoms or a pathology through refined testing.

Previously this has not been the case because, in the presence of risk factors, therapists have generally neglected the neural component.

Safety is the primary concern.

Indications

When pain that is easily provoked and takes a long time to settle after movement. This relates to Maitland's concept of irritability in which irritable problems are treated more gently and with greater caution than non-irritable problems (Maitland 1986).

Severe pain is present, a complete neurodynamic assessment may not be appropriate for ethical and safety reasons.

Latent pain – when the patient's pain develops a long time after physical testing. Latency carries risk because adequate warning of an imminent increase in symptoms does not occur at the time of testing.

Pathology is present either in the nervous system or the mechanical interface eg. a severe disc bulge or stenosed lateral recess in which pressure on the nerve root might be elevated and the excursion of the nerve root may be limited.

Neurological deficit may necessitate a level 1 examination so as not to provoke neural irritation or damage.

When a lasting increase in neurological symptoms is possible with neurodynamic testing.

Progressive worsening prior to physical examination.

Uncertain that the nervous system will tolerate standard testing (level 2 examination). If performance of a level 1 examination is found to be safe and does not reveal sufficient information, then the therapist may progress carefully toward a level 2 examination by gradually including more features of a level 2 technique.

Method (General Points)

Some of the components of a neurodynamic test may be omitted so that only minimal forces are applied to the nervous system.

It will also be necessary to modify the sequence of movements (eg. remote).

The therapist performs the usual neurodynamic tests and other mechanical tests for the musculoskeletal structures separately ie. simultaneous testing of the nervous system, interface and innervated tissues is avoided.

Restricted to evoking first onset of symptoms once only, if possible

Full range of motion is often not be achieved

The level 1 examination can provide sufficient information about the problem, particularly whether a neural component exists.

Structural differentiation is still performed, however, it takes a modified form.

Modified Structural Differentiation

Differentiating tension movement is performed prior to the application of any other test movements. The rest of the level 1 test is performed so that, at the first onset of symptoms, the differentiating movement can be released to produce a reduction in symptoms. This is instead of performing a differentiating movement that increases tension at the end of the neurodynamic test and so prevents further provocation of symptoms.

Structural differentiation becomes the 'off switch'.

Clinical Example: irritable wrist problem

- *contralateral lateral flexion*
- *shoulder abduction*
- *elbow extension*
- *structural differentiation (off-switch) - neck back to neutral position*

Level 2 - Standard

Description

Standard tests are used

Interface, neural and innervated tissues are tested/treated separately

Neurodynamic tests are performed to a comfortable production of symptoms only.

May be, but not necessarily, taken to end range.

Indications

The problem is not particularly irritable

Neurological symptoms are absent, or are only a minor part of the condition, and these neurological symptoms are not easily provoked

The problem is reasonably stable and is certainly not deteriorating rapidly

The pain is not severe at the time of examination, neither is there severe latency in terms of symptom provocation.

Method

The nervous system is effectively put through all its normal paces, but without combining neural tests with musculoskeletal ones. The test movements should not evoke excessive pain, neurological symptoms or go into a great deal of resistance.

Standard neurodynamic tests are used

Neural and musculoskeletal structures are examined separately

Movement into some symptoms is acceptable, as long as they are not severe and settle down immediately after the test

A degree of resistance may be encountered, however, it should not be strong

Full range of movement may be reached but this is not essential.

Level 3 – Advanced

General Description

Testing of the nervous system is more extensive than the previous levels.

Specificity and sensitivity are the focus and this is based heavily on the neuropathodynamic mechanisms.

Neural structures can be tested in relation to the musculoskeletal tissues - more sensitive.

Indications

Level 2 (standard) examination tests are normal, or do not reveal sufficient useful information, and the clinician wishes to investigate the problem more extensively

The problem is stable

When the patient's clinical pain is difficult to evoke

When there is no evidence of pathology that might adversely affect the nervous system

No neurological abnormalities eg. loss of conduction are present

High expectations in physical function.

In any patient from whom sufficient information has been gained by the execution of a level 1 or 2 examination, the **level 3 examination is unnecessary and contraindicated.**

Level/type 3a. Neurodynamically Sensitised

Definition

More neural tension is added to the standard neurodynamic test through the addition of sensitising movements.

Standard test but "more-of-the-same' technique"

- contralateral lateral flexion
- scapular depression
- shoulder horizontal extension

Method

The level 2 examination is performed prior to executing one at level 3. This is to be sure that the nervous system can cope with such testing.

Only the sensitizing movements of the standard neurodynamic test are added to the standard test.

Level/type 3b. Neurodynamic Sequencing (Localised)

Description

Local sequence - movements start locally and become progressively more remote.

A particular part of the nervous system is emphasized

Level/type 3c. Multistructural

Description

Neural structures are tested in combination with tests for musculoskeletal structures.

Generally used in the person with high expectations in terms of human function in which minor mechanical problems will provoke symptoms more easily than in patients whose needs are less extensive.

Often athletes, sports people and persons who work in occupational settings where high demands are a feature of their activities.

Method

Many movements and structures can be used.

Interface, neural and innervated tissues can be moved at the same time eg. opener and neural, with some innervated tissues testing also.

Neurodynamic sequencing is modified to suit the patient's specific pathodynamics.

Level/type 3d. Symptomatic Position or Movement

Description

Neural structures are tested in the position or movement that reproduces the patient's symptoms. This makes the manoeuvre relevant to the patient and offers an infinite number of opportunities to test the neural and musculoskeletal systems together.

Also may be performed after or during a symptomatic activity eg. throwing, writing or working at a factory.

Method

The patient nominates their provoking symptomatic position/movement and performs that particular manoeuvre.

Symptoms are then differentiated with remote movements.

Neurodynamic sequencing can be modified to suit the patient's needs eg. they might need to move into the relevant position in a certain way.

Differentiation of shoulder pain during a throwing action (eg. wrist movements)

Practical Exercises

Perform the following examination for:

- irritable wrist problem - proximal-to-distal sequence **(level 1)**
- minor wrist problem - distal-to-proximal sequence **(level/type 3b**
- irritable neck problem - distal-to-proximal sequence **(level 1)**
- minor neck problem - proximal-to-distal sequence **(level/type 3b)**

Should I Do a Neurological Examination?

A neurological examination should be performed:

- *when a neural component is suspected*
- *before and after significant neurodynamic techniques in treatment eg. level 3a*
- *making sure that a neurological deficit has not developed at the end of a course of treatment*
- *neurological deficit that was present in the first instance is changing for better or worse*
- *reassess progress when neurological problem is detected*
- *when performing contralateral neurodynamic movements - m ay have to do assess the effect of these movements to be assured that the contralateral technique has not produced any problems*
- *may be indicated when starting closer techniques for the first time after doing openers*
- *if in doubt, a neurological examination should always be performed.*

Section 5

Specific Neurodynamics

Audiovisual Presentation

NEURODYNAMIC SOLUTIONS
Clinical Neurodynamics Education

Specific Neurodynamics

1

Specific Neurodynamics

Definition

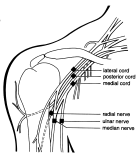
Local effects of body movement on the nervous system in a way that is specific to each region (Shacklock 2005).

2

Differential Movement of Spinal Nerves with Specific Tests?

Cords of the brachial plexus:

- *lateral*
- *posterior*
- *medial*



From Kleinrensink et al 2000, Clinical Biomechanics, with permission.

3

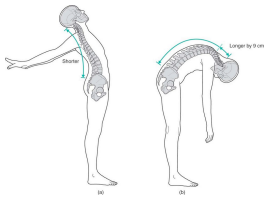
Effects Not Differential

	Median nerve		Ulnar nerve		Radial nerve	
	ULTI	ULTI+	ULTI	ULTI+	ULTI	ULTI+
Median nerve	+	+	·	·	+	+
Ulnar nerve	·	·	+	+	·	·
Radial nerve	·	+	+	+	+	+
Medial cord	+	+	+	+	+	+
Lateral cord	+	+	·	·	+	+
Posterior cord	·	+	+	+	+	+

From Kleinrensink et al 2000, Clinical Biomechanics, with kind permission

4

Mechanical interface - spinal canal



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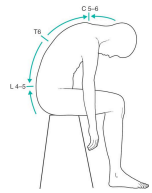
Convergence Toward C5-6, L4-5



Whole spine flexion produces movement of the nerves to C5-6 and L4-5.

6

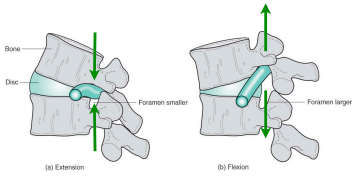
Effect of Neurodynamic Sequencing on Convergence

*Nerves converge **ONLY** to the joints that are moved*

neurodinamicaES

7

Intervertebral Foramen - interface



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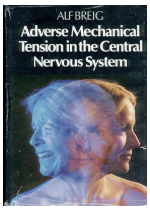
8

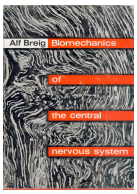
DR ALF BREIG - Swedish Neurosurgeon (1910-2006)

Original founder of adverse neural tension

9

Dr Alf Breig's Pioneering Work





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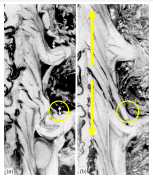
Spinal Cord



a. Extension

- shorter and compressed

b. Flexion

- tissues longer and slide

(Breig 1978)

© Neurodynamic Solutions (NDS)

11

Change in Diameter - cord

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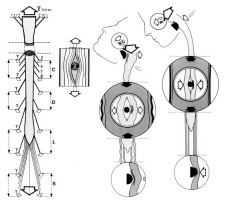

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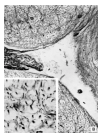
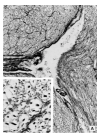
Lateral Spinal Cord - tension



Extension



Flexion

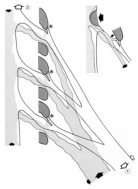
14

Lateral Flexion

Neural tissues on the convex side are tightened

Breig 1978

15



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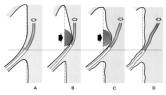

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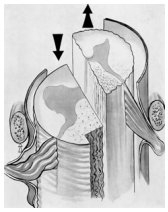

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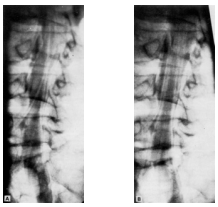

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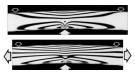

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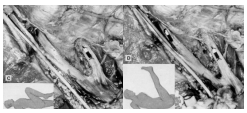

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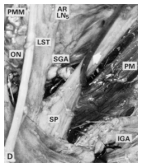

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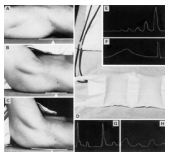

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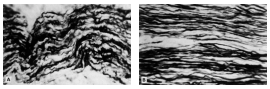

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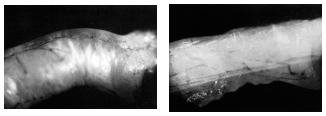
Independent Movement - arachnoid and pia maters



Breig 1960, 1978

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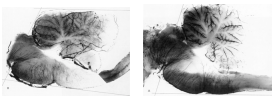

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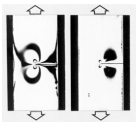

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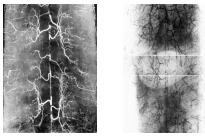

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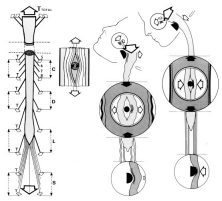

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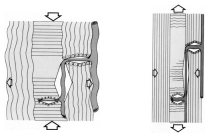

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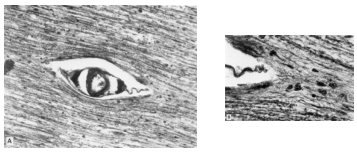

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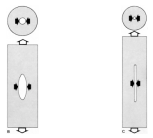

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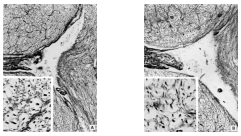

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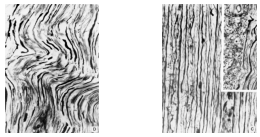

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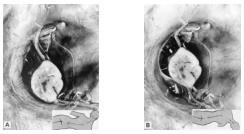

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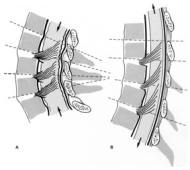

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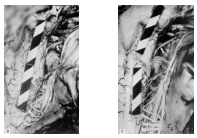

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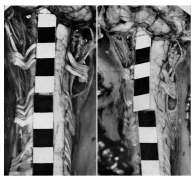
Rotation - right



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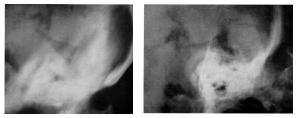
Fourth Ventricle



42

Trigeminal Nerve

Extension

Flexion

43

Two Models in Neurodynamics

A. Co-operative

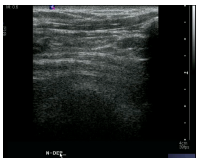
B. Competitive

44

Co-operative Model - tibial nerve at the ankle

45

Shoulder Depression



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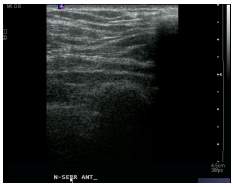
Lower Trapezius Contraction

47

Serratus Anterior Contraction



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Pectoralis Minor Stretch

49

Upper Trapezius Contraction

50

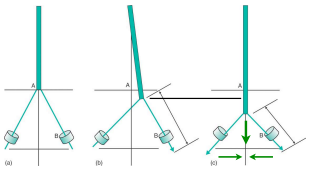
Shoulder Protraction

51

Shoulder Elevation

52

Contralateral Neurodynamic Tests



Shacklock 2005 Elsevier

53

Contralateral MNT1 (CMNT1)

95-97% of young asymptomatic subjects show a change in symptoms with the MNT1 with the CMNT1:

- *62% show a* ***decrease***
- *33% no change*
- *5% show increase*

Elvey 1979, Rubenach 1985

54

CMNT1 (cont.)

The CMNT1 often reduces tension in the nerve roots:

- can be used to **off-load** the nerve roots in the cervical spine

Technique is important:

- maintain scapular position and pressure constant
- body and limb positions must be accurate

55

CMNT1 (cont.)

Can:

- be used to reduce the power of a technique
- itself be progressed to higher or lower levels
- forms part of the progressional system of clinical neurodynamics

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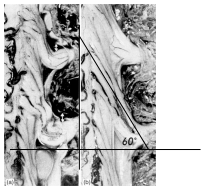
Contralateral and Bilateral Neurodynamic Tests

Bilateral MNT1

Bilateral SLR

57

Cervical Cord



Breig 1960, 1978

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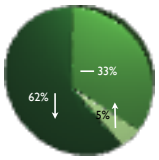
Effect of Contralateral Upper Limb Neurodynamic Test 1



Rubenach 1985

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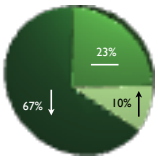
Effect of Bilateral SLR on MNT1 Response



Bell 1987

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Contralateral Slump Test

Control Sham Contralateral

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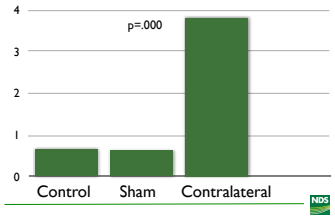
Effect of Contralateral Slump Tests



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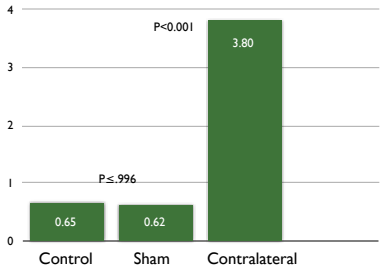

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Can Nerves Be Moved Specifically?

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Tibal Nerve

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