Manipulation of the Spine

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Manual Therapy

- **Definition:**
  - Techniques designed to increase soft tissue mobility, viability or inhibit pain (after Mulligan).
Manual Therapy

3 broad categories

- Articular Manipulation: Thrust and non-thrust

- Soft Tissue Mobilisation

- Active Mobilisation
  ◦ Mobilisation with movement (mwm)
Manual Therapy
Arthrokinematics

- Principles of Mobilisation
  - Roll
  - Glide
  - Articulation
  - Oscillation
  - Grade
  - Direction

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Manual Therapy Technique Choice

- Define the process(es) which are limiting mobility.

- Apply the best stimuli for the resolution of the limiting factor.
Manual Therapy Technique Choice

- **Distraction:** Forces 90 degrees to joint surface.
  - Decrease joint compression
  - Stretch capsule
  - Decrease pain/improve ROM

- **Gliding/Translation:** Forces parallel to joint surface
  - Improve joint gliding
  - Decrease pain/Inc ROM
Manual Therapy
Grades of Mobilisation

Grade I
- Activate Type I Mechanoreceptors
- Firing: Beginning and end range
- Location: Fascia and Superficial Joint capsule
- Recruit/Inhibit Type I Muscle Fibers
- Decrease Pain
- Slow adapting, activate with HOLD/STRETCH

Grade II
- Activate Type II Mechanoreceptors
- Firing: Beginning and mid range
- Location: Fascia and joint capsule
- Recruit/Inhibit Type II muscle fibers
- Decrease pain/Inc ROM
- Fast adapting, activate with mid range oscillation
Grade IV
- Activate Type I Mechanoreceptors
- Firing: Beginning and end range
- Location: Fascia and Superficial Joint capsule
- Recruit/Inhibit Type I Muscle Fibers
- Decrease Pain, INCREASE COLLAGEN ELASTICITY
- Slow adapting, activate with HOLD/STRETCH

Thrust Manipulation
- Activate Type III Mechanoreceptors
- Firing: QUICK STRETCH in mid/end range
- Location: Fascia and joint capsule
- SLOW adapting
- Huge inhibitory affect over multiple spinal cord levels
- Decrease pain/Inc ROM/Recruit or inhibit mm.
INDICATIONS FOR SPINAL MANIPULATIVE THERAPY

“High velocity, short amplitude thrust within range of joint motion aiming to inhibit pain and guarding and to normalize range of motion and somatovisceral reflexes” – Ola Grimsby

Manipulation is indicated for any joint restriction, joint stiffness, and/or pain in the absence of contraindications.
Potential Limiting Factors

- Muscle spasm
- Swelling
- Increased Tissue Viscosity
- Muscle Shortening
- Capsular Restriction
- Adhesion Formation
Muscle Guarding

- Identify the source of the spasm
  - Local sprain
  - Segmental spinal input
  - Regional sympathetic input
- Remove the cause of the guarding
Swelling

- **Viscosity**
  - Decrease to improve absorption
- **Increase fluid transportation in the area**
  - Mechanical
  - Exercise < 60% 1 RM
- **Do not provoke more swelling**
Increased Tissue Viscosity

- Result of immobilization

- Causes matrix dehydration due to Proteoglycan loss

- Reversed by stimulating the Fibroblast to produce Proteoglycan
Muscle Shortening

- Often adaptive, due to habitual postures or movements.
- Responds to passive elongation, and exercise in the lengthened range of the tissue.
Capsular Restriction

- Often due to trauma or arthritis.

- Responds well to articular mobilisation (Gd IV holds) and outer-range exercise.
Adhesion Formation

- Results from an inflammatory process.
- May be intra articular, peri-articular, intramuscular, etc.
- Respond well to passive mobilization, manipulation and exercise.
Treatments

- Treat all newly gained ROM as an instability
- Therefore, follow all manual techniques with active muscle contractions (EXERCISE)
Mobilisation Techniques

- Soft Tissue Mobilisation
- Articular Manipulation
  (Thrust and Non-thrust)
- Mobilisation Exercise
- Best when utilized in combination
Soft Tissue Mobilisation

- Can be used to influence tissue via:
  - Psychomotor Effects
  - High Afferent Input
    - Fluid Dynamics
    - Tissue / Scar lengthening
Articular Manipulation

- Can effect tissue via:
  - Psychomotor Effects
  - High Afferent Input
  - Fluid Dynamics
  - Tissue Length
Mobilisation Exercise

- Psychomotor Effects
- Fluid Dynamics.
  - <60% 1 RM
- Pain Inhibition.
- Tissue Elongation.
- Normalization of Movement.
- Improved Tissue Viability & Tolerances.
Manual Physical Therapy

- Effect on Cancel/No show rates
  - Value
  - Sense of Caring

- Compliance
  - Effective, Credible, Positive, Empathetic
  - Communication is Key (Wagstaff 1987)
CONTRAINDICATIONS TO SPINAL MANIPULATIVE THERAPY

Kleyhans AM, Terret AGJ, The prevention of complications from spinal manipulative Therapy, Aspects of Manipulative Therapy, 161–174
ABSOLUTE CONTRAINDICATIONS TO SPINAL MANIPULATIVE THERAPY

- Articular derangements:
  1. Acute arthritis of any kind
  2. RA with instability or acute
  3. Ankylosing spondylitis—acute
  4. Dislocation
  5. Hypermobility of segment
  6. Ruptured ligaments
  7. Trauma of recent occurrence—whiplash
  8. Advanced degenerative changes
  9. Congenital generalized hypermobility (Ehlers-Danlos syndrome)

- Bone weakening and destructive disease:
  1. Calve's disease
  2. Fracture
  3. Malignancy/tumor (primary/secondary)
  4. Osteomalacia
  5. Osteoporosis
  6. Osteomyelitis
  7. Tuberculosis (Pott's disease)
ABBREVIATED CONTRAINdications TO SPINAL MANIPULATIVE THERAPY

- Circulatory disturbances:
  1. Aneurysm
  2. Anticoagulant therapy
  3. Atherosclerosis
  4. Visceral arterial disease
  5. Calcification of aorta

- Disc lesions:
  1. Prolapse with serious neurological changes
  2. Evidence of more than one spinal nerve root on one side
  3. Cervical or thoracic joint conditions causing neuro signs in lower limbs
  4. Acute cervical or lumbar herniation
  5. Thoracic herniation
ABSOLUTE CONTRAINDICATIONS TO SPINAL MANIPULATIVE THERAPY

- Neurologic dysfunction:
  - 1. Micturition with sacral root involvement
  - 2. Painful movement in all directions
  - 3. Transverse myelitis
  - 4. Severe root pain
  - 5. Malformations of spinal cord including syringomyelia

- Unclassified:
  - 1. Infectious disease
  - 2. Uncooperative patient or patient intolerance
  - 3. Advanced diabetes when tissue value may be low
  - 4. Undiagnosed pain
RELATIVE CONTRAINDICATIONS TO SPINAL MANIPULATIVE THERAPY

- Articular derangements:
  1. Ankylosing spondylitis after acute stage
  2. Articular deformity
  3. Congenital anomalies
  4. Hypertrophic spondyloarthritis
  5. Osteoarthritis – especially severe or advanced
  6. Osteochondrosis
  7. RA – subacute
  8. Torticollis
  9. Inflamed joint

- Bone weakening and modifying disease:
  1. Hemangioma
  2. Paget's disease
  3. Scheuermann's disease
  4. Spondylolisthesis/spondyloysis with symptoms
RELATIVE CONTRAINDICATIONS TO SPINAL MANIPULATIVE THERAPY

Disc lesions:
1. Posterolateral and posteromedial disc protrusions
2. Degenerative disease

Neurological dysfunction:
1. Myelopathy
2. Non-vertebragenous pain
3. Pyramidal tract involvement
4. Radicular pain with disc lesion
5. Viscerosomatic reflex pain
RELATIVE CONTRAINDICATIONS TO SPINAL MANIPULATIVE THERAPY

- Unclassified:
  1. Abdominal hernia
  2. Asthma
  3. Dysmenorrhea
  4. Epicondylitis
  5. Long term steroid use
  6. Low pain threshold
  7. Peptic ulcer
  8. Post spinal surgery
  9. Pregnancy, especially first trimester
  10. Scoliosis
  11. Psychogenic disorders with dependence on manual therapy
  12. Patients who have been treated recently by another practitioner
  13. Signs and symptoms do not match
REGIONAL CONTRAINDICATIONS TO SPINAL MANIPULATIVE THERAPY

- Thoracic spine:
  1. Scoliosis
  2. Unilateral hemivertebrae

- Lumbar spine:
  1. Accessory sacroiliac joint
  2. Baastrup’s disease
  3. Cleft vertebra in sagittal plane
  4. Facet trophism
  5. Knife clasp syndrome
  6. Nuclear impression
  7. Progressive osteoarthritis of sacroiliac joint
  8. Pseudosacralization
  9. Sacralization, lumbarization
  10. Spina bifida occulta
  11. Spondylolisthesis (neighboring segments okay)
Summation

- Include the “Big 3” Treatment Concept when treating Pain/muscle guarding:
  - 1. Soft Tissue Mobilisation
  - 2. Joint Manipulation with sub max isometric holds
  - 3. Perform Active/Resistive movements to mobilise, vascularize, coordinate, and strengthen movement pattern
IDENTIFYING RED FLAGS FOR CLINICAL INSTABILITY OF THE UPPER CERVICAL SPINE
OBJECTIVES

• To teach you how to use your knowledge of anatomy and biomechanics to improve your evaluation skills
• To define clinical instability
• To describe the cardinal signs of and radiological criteria for cervical instability
• To describe precautionary tests and how when and why to use them
• To elucidate when it is necessary to refer the patient for further diagnostic work up
CLINICAL INSTABILITY

• The loss of the ability of the spine under physiological loads to maintain its pattern of displacement so that there is no initial or additional neurological deficit, no major deformity and no incapacitating pain. – White, Panjabi
KINEMATIC INSTABILITY

- Hypermobility
- Movement around a non-physiological axis
- Altered coupling characteristics
- Abnormal movement patterns
COMPONENT INSTABILITY

- Trauma related changes
- Structural changes related to pathology to include disease, degeneration and tumor
- Congenital/developmental changes
- Surgical changes
COMBINED INSTABILITY

- What we typically see clinically
- Component instability can lead to kinematic instability or vice versa
- Important to remember all of this can be present in the absence of symptoms
CERVICAL INSTABILITY: CLINICAL FINDINGS

- Cervical and facial pain
- Dizziness and nausea
- Occipital numbness/parasthesia
- Occipital headache, especially with looking down
- Tinnitus
- Metallic taste in the mouth
- Numbness of the tongue
- "Lump in the throat"
- Nightmares, panic attacks
CERVICAL INSTABILITY: CARDINAL SIGNS

- A history of "drop attacks"
- Facial/lip paresthesia reproduced by active or passive movements
- Bi or quadrilateral limb parasthesia, either continuous or reproduced/aggravated by head or neck movements
- Nystagmus produced by active or passive movements of the head or neck
CLINICAL INSTABILITY: OTHER CLINICAL SIGNS

- Acute 'wry neck' or 'cock robin' position
- 'Splinting' head held in midline, motion severely restricted in all directions
- Supports head with hands while changing positions
- Short neck with low hairline
- Marked inability to push the chin up or press it down against resistance
- Delayed myelopathy with clumsiness and weakness of hand movements, spastic weakness of the lower limbs and hyperreflexia
- Ankle clonus, + Babinski
CLINICAL INSTABILITY: COMMON HISTORY

- A recent trauma to the head or a quick, unguarded movement
- Severe trauma to the head or neck – motor vehicle accident, fall
- A history of rheumatoid arthritis or ankylosing spondylitis
- A history of Down's syndrome, congenital fusion or dysplasia of the cervical spine
- A recent severe sore throat from infection
CLINICAL INSTABILITY: POTENTIAL CAUSES

- Ankylosing spondylitis
- Rheumatoid arthritis
- Down's syndrome
- Congenital fusion C1C2.
- Klippel–Feil
- Pharyngeal infection
- Cong Posttraumatic or accumulated micro trauma
- Congenital anomalies of the Odontoid
- Congenital laxity of the transverse ligament
- Fracture of the Odontoid
- AA dislocation
- Morquio syndrome
CLINICAL INSTABILITY: EVALUATION

- Initial observation – head/cervical posture and gait
CERVICAL INSTABILITY: EVALUATION

- Neurology – DTRs, sensation and myotomes. Marked inability to push the chin up or press it down against resistance. Cranial nerve tests and other cord signs

- Compression/distraction – very light compression may spur apprehension and cord signs, distraction in neutral first then with slight flexion and extension
CERVICAL INSTABILITY: CERVICAL PRECAUTIONARY TESTS – FIRST A WORD ON THE VERTEBRAL ARTERY

• Margarey et al 2004: "it appears that, often, the symptoms detected during premanipulative testing may be unrelated to alterations in blood flow of the VA". Suggested greater emphasis be placed on identifying potential indicators of risk in pt. hx

• Kerry 2005: Doing the VA test and asking the patient about dizziness, dysarthria, dysphasia, diplopia and drop attacks (5 D's) not enough to ID those at risk

• Mitchell et al 2004: demonstrated that young, normal females will experience a reduction in flow of contralateral VA without any symptoms
CERVICAL INSTABILITY: CERVICAL PRECAUTIONARY TESTS – FIRST A WORD ON THE VERTEBRAL ARTERY

- Mitchell 2005: "We endorse our colleagues assertion that the VBI test is still without demonstrated or proven validity, sensitivity or specificity.....there is still no convincing evidence of a method for identifying at risk patients“

- Kerry and Taylor 2005: "The VBI test remains without known sensitivity or specificity and therefore clinical decisions made on the basis of the results of such a rest should be carefully thought out“

- Kerry and Taylor 2006: "Reliance on clinical tests, i.e., so called vertebral artery test, which have poor validity and reliability should be avoided"
CERVICAL INSTABILITY: CERVICAL PRECAUTIONARY TESTS – ALGORITHM

• Results can be positive, negative, false positive or false negative

• Tests can be reduction tests or provocation tests, must implicate and then confirm

• Testing procedure is a stepwise progression from least aggressive to maximal testing positions
CERVICAL INSTABILITY: CERVICAL PRECAUTIONARY TESTS – SHARP – PURSER TEST
CERVICAL INSTABILITY: CERVICAL PRECAUTIONARY TESTS – PROGRESSION – SUPINE

• A. Lift C1 transverse processes– hold to provoke
• B. Lift head and C1 transverse processes
• C. Flex OA, lift head and C1 transverse processes, flex C–spine
• If negative for transverse ligament laxity then check Dens/arch of C1
• D. Lift C2 articular pilar
• E. Translate head and C1 posterior, hold C2 anterior
• F. Extend OA, translate head and C1 posterior, hold C2 anterior
CERVICAL INSTABILITY: CERVICAL PRECAUTIONARY TESTS – PROGRESSION – SUPINE

• If A through F negative then check Alar ligament and lateral masses

• G. Side glide lateral mass of C1 with ipsilateral side bending

• H. Side shear C1 and head, stabilize C2

• I. Alar ligament test
CERVICAL INSTABILITY: PRECAUTIONARY TESTS – PROGRESSION – COMBINED MOVEMENTS

- OA joint flexion and rotation
- OA joint extension and rotation
- AA joint rotation and flexion
- AA joint rotation and extension
CERVICAL INSTABILITY: REFERENCES


• Aspinal W. Clinical testing for the craniovertebral hypermobility syndrome. JOSPT 12:2 Aug. 1990


Vertebral Basilar Infarct (VBI)

- VBI is a decrease of blood flow in the posterior blood vessels supplying the brain.
Vertebral Basilar Infarct (VBI)

Circle of Willis
Vertebral Basilar Infarct (VBI)
Circle of Willis

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Performed Meta–Analysis on studies concerning VA blood flow during cervical rotation

Studies reviewed look at all levels of the VA as described in literature V1, V2, V3, and V4

9 studies met the requirements

Found contralateral rotation produced greatest change in blood flow

V4 was areas most compromised with sustained full rotation in sitting
Conclusion

More studies similar to ones reviewed need to be performed in multiple groups for both men and women

In health subjects and in patients

VBI test can demonstrate the functional state to allow referral for further examination

Test cannot be used to fully support safety of HVLA thrust manipulation
Recommend the use of the term cervical artery dysfunction, since multiple preexisting pathologies can be present

Much of research recommends screening, yet many do not fully validate the test

Minimal exam should involve full sustained rotation to monitor for S/S of a dysfunction

Dissection of the VA most likely from pathology of the endothelium
Atherosclerosis common with the internal carotid artery and can be area of injury with manual treatment (thrombus)

Bottom line is thorough multi-system Exam and history to identify additional comorbidities that place an individual at greater risk
Signs/Symptoms VBI

- Anhidrosis (lack of facial sweating)
- Ataxia
- Clumsiness and agitation
- Diplopia
- Dizziness
- Drop attacks
- Dysarthria
- Dysphagia
- Facial numbness
- Hearing disturbances
Signs/Symptoms VBI

- Hoarseness
- Hypotonia/limb weakness (arm or leg)
- Loss of short-term memory
- Malaise
- Nausea
- Nystagmus
- Pallor/tremor
- Papillary changes
- Perioral dysthesia
- Photophobia
- Vagueness
- Vomiting
ICA dissection Signs/Symptoms

- Non-ischemic (local) signs/symptoms
- Horner’s syndrome
- Pulsatile tinnitus
- Cranial nerve palsies (most commonly CN IX to XII)
- Less common local signs and symptoms
  - Ipsilateral carotid bruit
  - Scalp tenderness
  - Neck swelling
  - CN VI palsy
  - Orbital pain
  - Anhidrosis (facial dryness)
ICA dissection Signs/Symptoms

- Ischemic (cerebral or retinal) signs/symptoms
  - Ischemic stroke (usually middle cerebral artery territory)
- Transient ischemic attack (TIA)
- Retinal infarction
- Amaurosis fugax
  - Temporary full or partial loss of vision—atraumatic
Reviewed cases of vertebral and Internal carotid artery dissections at a hospital from 1998–2009

Viewed cases under 55 years with confirmed VBAD or ICAD by radiology

Reviewed 47 confirmed cases and 43 controls that matched both age and sex of confirmed cases
27 were VBAD and 20 ICAD
64% recent head trauma
23% manual therapy
26% recent infection
36% with craniocervical vascular anomalies
Most common signs/symptoms were HA, dizziness, neck pain
HA present in 85% of the cases
Control group had significant less percentage than dissection group with the risk factors
Conclusion:

Recent neck trauma, CAD, and recent manual therapy were statistically significant.

PT should be aware of all minor vascular signs/symptoms.

Many cases go undetected and any signs/symptoms that can have vascular connection warrant further examination.

Including cranial nerves and balance issues.
Validity of the anterior shear test for transverse ligament and the distraction test for integrity of the tectoral membrane

Pre-test MRI were performed to observe integrity of ligaments and of the upper cervical spine

16 healthy subjects received MRI in supine with test being performed

Measurements were taken from a neutral position and compared to test position
There was a statistical difference in both Mean difference was .41mm – .67mm for transverse ligament Men difference was .64mm for the distraction test The findings do demonstrate and support that the test produce movement they are intended to cause Motion is this study was minimal, yet significant
Limitations may have been PT position and ability to hold for 3 mins while MRI film was taken.

It can further be concluded that in a compromised ligament that less force may be required and the end-range needed to produce symptoms may be obtained easier.

Therefore, this study is the first to demonstrate the anterior shear and distraction test have clinical validity.