Welcome

- Evidence Based Evaluation and Manipulation of the Lumbopelvic Spine
- What's in your toolbox?

Today's Goals

- Briefly review the evidence for manipulation of the lumbar/thoracic/cervical spine
- Introduce/refine MT techniques for all spinal regions
- Increase proficiency of selected techniques
- Increase confidence in your MT skills
- Provide clinical pearls
- Use this stuff in your next clinical setting

Barrier Concept

Grades of Movement

Grades of Movement

Grades of Movement

G. D. Maitland

<table>
<thead>
<tr>
<th>GRADE</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>I</td>
<td>Small amplitude out of resistance (R1)</td>
</tr>
<tr>
<td>II</td>
<td>Large amplitude out of resistance</td>
</tr>
<tr>
<td>III</td>
<td>Large amplitude into resistance</td>
</tr>
<tr>
<td>IV</td>
<td>Small amplitude into resistance</td>
</tr>
</tbody>
</table>

III- or IV- performed at 25% into restricted range
III or IV+ performed at 50% into restricted range
III++ or IV++ performed at restricted barrier (R2)

Grades I and II used to treat pain prior to reaching resistance
Grades III and IV used to treat resistance (joint restrictions) when pain is not a limitation

Mobilization Principles

G. D. Maitland; P. E. Greenman

- Patient must be completely relaxed
- Operator must be relaxed
- Patient must be comfortable and have complete confidence in the operator’s grasp
- Embrace the joint to be moved, hold around the joint to feel movement
- Move one joint, one motion at one time
- Patient must be confident that the joint will not be hurt
- Operator’s position must be comfortable and easy to maintain
- Operator’s position must afford him/her complete control

Lumbar Spine


Clinical Anatomy

- Why anatomy?
  - Function of the Spine:
    - Supports the body
    - Facilitates movement
    - Protects the spinal cord
    - Shock absorber
  - Trivia:
    - 97 joints
    - 23 intervertebral discs
Ligaments

- **Anterior Longitudinal Lig. (ALL)**
  - Atlanto-occipital membrane → sacrum
  - Thin and weak
  - Pain sensitive
  - Stabilizer
  - Anterior and lateral connections
  - Attaches to the PLL
  - Attaches to the IVD
  - Loose against the VB – allows blood to enter

- **Posterior Longitudinal Lig. (PLL)**
  - Foramen magnum → sacrum
  - Anterior to neural sac and posterior to the VB and IVD
  - Thinnest part in the L-spine
  - Prevents disc moving into dura
  - Attached to IVD not the VB
  - Attaches laterally to the ALL
  - Very pain sensitive
  - Very rich venousplexus

- **Ligamentum Flavum**
  - Lamina of each vertebral level
  - Segmental
  - Elastin fibers
  - Reinforces medial capsule of ZPJ
  - No nerve supply
  - Increases size with aging
  - Spinal stenosis
  - ++ Fatty tissue

- **Interspinous Ligament**
  - Not very big
  - Tenses with flexion
  - Segmental
  - Pain sensitive

- **Supraspinous Ligament**
  - Over the spinous processes
  - Not pain sensitive

- **Other ligaments?**

Zygapophyseal (Facet) Joints

- **Synovial joint:**
  - Articular cartilage
  - Capsule
  - Synovial fluid
  - Synovial membrane
  - Ligament
  - Function: protects the IVD

- **Medial:**
  - Ligamentum flavum
  - Multifidus
  - Fatty tissue plugs → highly vascularized
  - Allows flexion – but also stops flexion to decrease shear on IVD

Intervertebral Disc

- **Nucleus Pulposus:**
  - Gelatinous micro protein and collagen – proteoglycan
  - Hydrophilic
  - NP 90% fluid at birth and decreases to 70%
  - Conforms to pressure
  - Hydration
  - No circulating blood
  - L-spine: NP situated more posteriorly
**Neuroanatomy and Neurodynamics**

- Main role: Electrochemical communication
- Designed to move, slide and glide
- Spinal cord ends at L1/2 → cauda equina

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**Lumbopelvic Region Manipulation: Supine**

- Translate the pelvis toward you and maximally side-bend the patient’s lower extremities and trunk to the right
- Without losing the right side-bending lift & rotate the trunk so the patient rests on their left shoulder
- Contact the patient’s right ASIS with your left hand
- Grasp the top shoulder and scapula with your right hand and rotate the trunk to the left while maintaining the right side-bending
- Once the right ASIS starts to elevate, perform a smooth thrust in an anterior to posterior direction
- Reassess symptoms and impairments

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**Lumbopelvic Region Manipulation: Supine with Alternate Operator Arm Position**

- Same setup as previous technique
- Instead of shoulder/scapular grip, thread your cephalad forearm through the patient’s arms. Rest your fingertips on the patient’s sternum or the table.

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**Segmental Neutral “Gapping” Manipulation**

- Flex the top leg until you first begin to palpate motion at L4-L5 interspace; place the patient’s foot in the popliteal fossa as shown
- Grasp the patient’s right arm and shoulder and induce right side-bending & left rotation until you begin to palpate motion at the L4-L5 interspace
- Place your left thumb on the left side of the L4 SP & position the patient’s arms around your left arm
- While maintaining your setup log roll the patient towards you
- While monitoring the right side of the L5 SP, use your right arm to induce a high velocity, low amplitude (HVLA) thrust in anterior direction

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**Thoracic Spine Evidence**

Thoracic Spine Evidence


Thoracic Spine Evidence—Shoulder


Clinical Anatomy of the Thoracic Spine

- Ratio disc: body height is 1:3 compared to 1:5 in C spine and 1:3 in L spine
- Some report annulus is stronger and this helps T Spine resist rotational stress
- T6 Vertebra contributes to normal kyphosis
- Each body has paired costal demi-facets posterolaterally (↑↓)
- AP and transverse dimensions almost equal
- Height of body is slightly higher posteriorly – said to account for mobility

Osteology

- AP and transverse dimensions almost equal
- Height of body is slightly higher which contributes to normal kyphosis
- Each body has paired costal demi-facets posterolaterally (↑) except T10, 11 & 12
- Transitional zone between C and L spines
- Second least mobile of the spinal regions (sacrum is least mobile)
- Ribcage and low ratio of IVD height to vertebral body height (1:5) said to account for mobility

(DiGiovanna and Schiowitz, 1991)
**Osteology**

- Laminae are higher than wider and overlap 'like tiles on a roof'
- Limits extension

**Superior facet slightly convex and posteriorly oriented 60º from horizontal plane and 20º from frontal plane**
- Inferior facet slightly concave and face anteriorly, slightly inferiorly and medially to match superior facets of vertebra below

**Rule of ‘threes’? Valid?**

<table>
<thead>
<tr>
<th>Vertebral body</th>
<th>Spinous Process Level*</th>
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<tbody>
<tr>
<td>T1 – T3</td>
<td>Same level</td>
</tr>
<tr>
<td>T4 – T6</td>
<td>Half a level below</td>
</tr>
<tr>
<td>T7 – T9</td>
<td>One whole level below</td>
</tr>
<tr>
<td>T10</td>
<td>One whole level below</td>
</tr>
<tr>
<td>T11</td>
<td>Half a level below</td>
</tr>
<tr>
<td>T12</td>
<td>Same level</td>
</tr>
</tbody>
</table>

**Thoracic Disc**

- Wood et al (1993) conducted T Spine MRI evaluations on 90 asymptomatic subjects
  - 68% had abnormalities
  - 24% had frank disc herniation
  - 42% had bulging discs
  - 46% had annular tears

**Facet motion**

- Flexion (opening): inferior facet moves superiorly and slightly anteriorly on the superior on the superior facet of the segment below
- Extension (closing): opposite of flexion

**Coupled motions?**

- Like the lumbar spine, little evidence to support theory
- Minimal investigation of coupled motion
- Theory
  - In a flexed position side bend and rotation occur in opposite directions
  - In an extended position side bend and rotation occur in the same direction
MANUAL THERAPY PROCEDURES
Thoracic Spine

Seated Distraction Manipulation
Seated CT Junction Manipulation
Supine Flexion Bias Manipulation
Supine Extension Bias Manipulation of the Upper Thorax
Supine Rib Manipulation
Prone Extension Bias Manipulation

Cervico-Thoracic Junction Distraction Manipulation
A high-velocity, mid-range, distraction force to the lower cervical spine on the upper thoracic spine in a sitting position

- Your chest should be level with patient’s CT junction
- With patient seated, have them interlock their fingers at the base of their neck
- Weave arms through the patient’s arms until your hands are resting slightly below the patient’s hands
  (Patient’s elbows should be relaxed)
- Support patient with compression of forearms
- Lean patient back until C-T junction is perpendicular to the floor
- Extend knees, lifting the patient vertically producing a distraction thrust at the C-T junction

Myology

Deep ↓
Superficial

Mid-Thoracic Manipulation
A high-velocity, mid-range, distraction force to the midthoracic spine on the lower thoracic spine in a sitting position

- Patient seated with back near edge of table
- Have patient grasp opposite shoulders, ensuring patient’s arm is over the other arm
- Fulcrum the patient’s thoracic spine into flexion by grasping the patient’s elbows and leaning into the patient with your upper body (J-stroke)
- Extend knees, lifting the patient vertically while emphasizing flexion and distraction of the thoracic spine

Seated CT Junction Manipulation
Supine Flexion Bias Manipulation
Supine Extension Bias Manipulation of the Upper Thorax
Supine Rib Manipulation
Prone Extension Bias Manipulation

Supine Thoracic Manipulation
High-velocity, end-range, anterior-posterior force through the elbows to the middle thoracic spine on the lower thoracic spine in a supine position, in cervicothoracic flexion

- Cross the patient’s arms across her chest (right above the left in this example)
- Establish your left hand contact medial to the transverse processes of the inferior vertebra
- Localize motion through the patient’s arms. Further localize by flexing, left sidebending, and left rotating from above down to the dysfunctional segment
- Once the barrier is engaged, apply a high velocity, low amplitude thrust with your body in an anterior to posterior direction. The thrust introduces a flexion moment to open the right zygapophyseal joint and related structures.

You can use a pillow instead of lifting the head.
Use a towel roll on the sternum.
Supine Extension Manipulation of the Upper Thorax

A high-velocity, end-range, A-P force through the elbows to the cervicothoracic junction on the upper thoracic spine in a supine bridged position.

- Patient supine with feet on the table and arms crossed. The therapist rolls the patient towards him & using the thenar eminence achieves a skin lock fulcrum on the T1 segment (between the SP and TP) by PULLING Caudally.
- The patient is rolled over onto the fulcrum and asked to bridge up
- An anterior-posterior thrust is directed toward the fulcrum

Supine Extension Manipulation of the Upper Thorax (Alternate)

- Modify the previous technique by placing the patients hands behind the base of the neck

Supine Rib Manipulation

- Standing on the unaffected side, cross the patient’s arms, one on top of the other, ensuring the arm that is away from you is on top
- Place your thenar eminence on the rib angle of the level you are working on and perform a skin lock
- Localize the motion on the specific rib by flexing sidebending, and rotating the patient’s head towards you
- With the rib locked in place, perform a high velocity, low amplitude thrust in an anterior to posterior direction

Prone Thoracic Manipulation

A high-velocity, mid-range, posterior-to-anterior force to the midthoracic spine on the upper thoracic spine in a prone position.

- Instruct patient to lie prone and stand on the side you are closing
- Instruct the patient to turn head towards you
- At level of restriction, place left hand on transverse process on your side and rotate fingers caudally
- At same level, place right hand on opposite transverse process and rotate fingers cephalad
- Instruct patient to take a deep breath and exhale
- Continue to rotate hands and take up slack as patient exhales
- Perform high velocity thrust at end of exhalation

Cervical Spine

Cervical Spine


Respect the Neck

- Soft therapeutic hands
- Patient is in charge
- Get permission
- Feedback is critical

Mid-Low Cervical (C2-C7) Central PA Mobilizations

- **Patient position**
  - Prone, face down in slight cervical flexion
- **Therapist position**
  - Stand at the head of patient
  - Thumbs positioned over spinous process to be assessed or treated
  - Use fingers on paracervical muscles to help stabilize the neck
  - Lean forward over patient with arms straight and shoulders over thumbs
- **Mobilization technique**
  - Gently lift up with both hands to take up soft tissue slack
  - PA mobilization with trunk movement. Keep arms perpendicular to patient.
  - Grades I to IV used depending on patient's pain and stiffness symptoms

Mid-Low Cervical (C2-C7) Unilateral PA Mobilizations

- **Patient position**
  - Prone, face down in slight cervical flexion
- **Therapist position**
  - Stand at the head of patient
  - Thumbs positioned over articular pillar/facet joint to be assessed or treated
  - Use fingers on paracervical muscles to help stabilize the neck
  - Lean forward over patient with arms straight and shoulders over thumbs
- **Mobilization technique**
  - Gently lift up with both hands to take up soft tissue slack
  - PA mobilization with trunk movement. Keep arms perpendicular to patient.
  - Grades I to IV used depending on patient's pain and stiffness symptoms

Mid-Low Cervical (C2-C7) PPIVMs (Rotation/Lateral Flexion)

- **Patient position**
  - Supine position, head off table
- **Therapist position**
  - Stand at the head of patient
  - Support patient's head with palms of both hands, fingers palpating posterior articular pillars of Rx level
- **Mobilization technique**
  - PPIVM C-spine into neutral F/E at the desired Rx level
  - **Right Rotation**: Rotate cervical spine at the desired motion segment by gently pulling with left hand and passively “observing” with right hand
  - **Right Lateral Flexion**: Side head the cervical spine with left hand, using right finger contact as a fulcrum
  - Palpate facets for both techniques

Mid-Low Cervical (C2-C7) Local Rotation Mobilizations

- **Patient position**
  - Supine position, head off table
- **Therapist position**
  - Stand at patient’s head in walk-stance, facing towards the side of rotation
  - **PPIVM C-spine into neutral F/E at the desired motion segment for treatment**
  - Left hand (Rx side) contacts the superior segment articular pillar using the MCP joint of index finger
  - Right hand uses chin grip with forearm supporting side of head
- **Mobilization technique**
  - With hands working together, apply a pure left rotation motion away from the painful (left) side
  - Graded mobilizations are performed into resistance or centralizing range

Treating left side
Mid-Low Cervical (C2-C7)
Translation Motion Testing

- Patient position
  - Supine position, head resting on table or pillow
- Therapist position
  - Sit or stand at the head of patient
  - Place your index and middle fingers over the articular pillars of the superior vertebral segment. Control the head with your palms and theor eminences
- Motion testing technique
  - Assessing for Extension Restrictions
    - Translate obliquely/exterterely to bias into extension. Add left to right lateral translations to test for “closing” restrictions of left facet joint.
  - Assessing for Flexion Restrictions
    - Flex head and neck to motion segment. Add left to right lateral translations to test for “opening” restrictions of right facet joint.

Mid-Low Cervical (C2-C7)
Muscle Energy - Flexion restriction

- Patient position
  - Supine position, arms relaxed, head resting on treatment table or pillow
- Therapist position
  - Sit or stand at head of patient
  - Left hand uses “V” grip with thumb on left superior articular pillar and index finger blocking the left side facet joint
  - Right hand controls forehead
- Muscle Energy technique
  - Bring cervical spine into F w/ both hands until Rx level reached
  - Apply left to right (restricted side) translation with left index finger or MCP
  - Perform MET w/ small isometric forces into F or right LF/ROT
  - Re-engage barrier, repeat 3-5 times

Mid-Low Cervical (C2-C7)
Muscle Energy - Extension restriction

- Patient position
  - Supine position, arms relaxed, head resting on treatment table or pillow
- Therapist position
  - Sit or stand at head of patient
  - Right hand uses “V” grip with thumb on left superior articular pillar and index finger blocking the left side facet joint
  - Left hand controls forehead
- Muscle Energy technique
  - Bring cervical spine into E w/ both hands until Rx level reached
  - Apply left to right (restricted side) translation with left index finger or MCP
  - Perform MET w/ small isometric forces into E or right LF/ROT
  - Re-engage barrier, repeat 3-5 times

Mid-Low Cervical (C2-C7)
Manipulation - flexion restriction

- Patient position
  - Supine position, arms relaxed, head resting on treatment table or pillow
- Therapist position
  - Sit or stand at head of patient
  - Pulpate index and middle fingers over the articular pillar while flexing C-spine
- Manipulation technique
  - Bring cervical spine into F w/ both hands until Rx level reached
  - Apply right to left (restricted side) translation with right and MCP, guiding head into right LF/ROT
  - Perform high velocity, low amplitude thrust into left translation towards the painful side with 2nd MCP

Mid-Low Cervical (C2-C7)
Manipulation - extension restriction

- Patient position
  - Supine position, arms relaxed, head resting on treatment table or pillow
- Therapist position
  - Sit or stand at head of patient
  - Right hand index and middle fingers contact right inferior articular pillar of superior segment
  - Left hand controls the patient’s head and neck
- Manipulation technique
  - Translate cervical spine into extension using contact fingers of right hand
  - Right hand applies right LF/ROT to motion barrier using right hand finger contact as a fulcrum (close to max joint play)
  - Perform HVLA thrust in direction of the T1 spinous process w/ 2nd MCP

Cervical Rotation Manipulation (Upslope/Non-physiologic)

- Patient Position
  - Supine with pillow under head
  - With the bottom side therapist’s hand maintaining contact with the neck
- Therapist Position
  - Place right MCP on the articular pillar of the superior joint
  - Left rotate cervical spine 60-70° without inducing sidebending
  - Right sidebend to engage barrier and provide “final minor adjustments”
- Manipulation technique
  - Apply a gentle HVLA thrust into left rotation in a 45 degree plane, towards the opposite eye

This should be very gentle and comfortable to the patient!