SUNCOAST SEMINARS

PRESENTS:

An Introduction to Manual Therapy
For PT’s and PTA’s®

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Course Objectives
After attending this course, attendees will
• have learned about the history of manual therapy
• understand the differences in Practice Acts between PT's, PTA's and Chiropractors
• understand the definition of manual therapy and skilled passive range of motion
• appreciate arthrokinematics and be able to apply evidence based techniques to facilitate joint movement
• be able to differentiate the different classifications of mobilization
• appreciate the importance of documentation learned about the most common joints to receive mobilizations
About the educator

• Background
• Education
• Work experience
• Hobbies
So what is Manual Therapy?
Let’s look at a few commonly used definitions/descriptions:
• Manual therapy, manipulative therapy, or manual & manipulative therapy encompasses the treatment of health ailments of various etiologies through passive movement techniques
• CPT Code 97140: Manual therapy techniques (e.g. mobilization, manipulation, manual lymphatic drainage, manual traction) one or more regions, each 15 minutes
• Skilful handling with the hands to give a therapeutic effect.
• To work with one's hands.
Hands-on treatment that is used to restore motion to the joints of the body. This type of therapy includes care from physical therapists, chiropractors and other rehabilitation team members.

Manual therapy uses hands-on techniques to improve range of motion in restricted joints. It is also used to stimulate the function of muscles, nerves, joints, and ligaments.

Encompasses the treatment of health ailments of various etiologies through 'hands-on', physical intervention.

A consensus study of US chiropractors [1] defined manual therapy as "Procedures by which the hands directly contact the body to treat the articulations and/or soft tissues."
Manual therapy may be defined differently (according to the profession describing it for legal purposes) to state what is permitted within a practitioner's scope of practice.

Within the physical therapy profession, manual therapy is defined as a clinical approach utilizing skilled, specific hands-on techniques, including but not limited to manipulation/mobilization, used by the physical therapist to diagnose and treat soft tissues and joint structures for the purpose of modulating pain; increasing range of motion (ROM); reducing or eliminating soft tissue inflammation; inducing relaxation; improving contractile and non-contractile tissue repair, extensibility, and/or stability; facilitating movement; and improving function.
• Alternatively, Korr (DC)(1978) described manual therapy as the "Application of an accurately determined and specifically directed manual force to the body, in order to improve mobility in areas that are restricted; in joints, in connective tissues or in skeletal muscles."

• **PT Guide to Practice:** Mobilization/Manipulation = “A manual therapy technique comprised of a continuum of skilled passive movements to joints and/or related soft tissues that are applied at varying speeds and amplitudes, including a small amplitude/high velocity therapeutic movement”
Chiropractic Association: 'Adjustment or manipulation' means the forceful movement of joints or tissue to restore joint function, in whole or part, to increase circulation, to increase motion, or to reduce interosseous disrelation. 

"Comprising a continuum of skilled passive movements to the joints and/or related soft tissues that are applied at varying speeds and amplitudes, including a small-amplitude and high-velocity therapeutic movement.”
So, should Manual Therapy be restricted to one profession? Let’s look at how Manual Therapy came to be
History of Manipulation

- Hippocrates, Father of Medicine
  - 460-355 B.C.
  - Wrote “On Setting Joints by Leverage”
  - Spinal Traction
  - Reduction of dislocated shoulders
History of Manipulation: Bone Setters

• Friar Moulton

• Bone setting flourished in Europe during the period of 1600-early 1900’s
  – No formal training
  – Techniques passed down within families
  – Clicking sounds thought to be due to moving bones back into place
History of Manipulation

- Wharton Hood
  - 1871, “On Bone-setting”
    - first such book by an orthodox medical practitioner
    - Hood thought snapping sound was due to breaking adhesions
  - PT evolved from Medicine
  - Precedes Osteopathy and Chiropractic
    - In 1887, PTs were given official registration by Sweden’s National Board of Health and Welfare
    - 1899 Chartered Society of Physiotherapy founded in England
Andrew Still founded Osteopathy in 1874

– 1896 founded the first school of Osteopathy in Kirksville, Missouri
– “Rule of the Artery” - Manipulate the spine to restore blood flow and restore body’s innate healing ability
– Osteopaths currently licensed to practice medicine in all states
History of Manipulation: Chiropractic

Founded 1895

- “Chiropractors do not manipulate; they do not use the process of manipulating; they adjust.”

History of Chiropractic

• DD Palmer, a magnetic healer and green grocer applied an “adjustment” to Harvey Lillard in September 1895 to the T4 vertebra that resulted in restoration of lost hearing

• Concept of “subluxation” as a causal factor in disease and the revelation that adjustments can restore the body’s innate healing abilities

• Palmer School of Chiropractic founded in 1897 in Davenport, Iowa
History of Manipulation: Chiropractic Philosophy

• 'Adjustment or manipulation' means the forceful movement of joints or tissue to restore joint function, in whole or part, to increase circulation, to increase motion, or to reduce interosseous disrelation.
History of Manipulation: Chiropractic Philosophy

- 1904, BJ Palmer (1881-1961) gained operational control of the School and continued until 1961
- BJ is considered the “Developer” of chiropractic and defender of “straight” chiropractic
- “Straights” adhere to original philosophy
- “Mixers” incorporate other modalities
History of Manipulation

- Chiropractors claim to be the first professionals to develop manipulation
- Chiropractors have a 110+ year history of practicing and protecting their right to manipulate
- All other professions are infringing on the chiropractic scope of practice who wish to use manipulation
History of Manipulation: Physical Therapy in Sweden (1813)

Per Henrik Ling “Father of Swedish Gymnastics” founded Royal Central Institute of Gymnastics (RCIG) in 1813

Medical gymnastics
Educational gymnastics
Military gymnastics

Swedish word for physical therapist is “sjukgymnast” = “gymnast of the sick”

Practitioners came from throughout Europe to learn PT techniques at RCIG including Jonas H. Kellgren (1837-1916)

(Grandfather to James Cyriax)
History of Manipulation: US
PT’s vision on Manipulation:

• Mary McMillan, 1st president of APTA (founded 1921)

• The four branches of physiotherapy: “namely-manipulation to muscle and joint, therapeutic exercise,… electrotherapy, and hydrotherapy.”

McMillan uses the word “manipulation” throughout her book to describe techniques such as effleurage, tapotement, friction massage, paddle technique.
History of Manipulation:
US PT history.

1925 – 1939: Yearly publications in Physical Therapy literature on Manipulation and related topics
1940 – mid 1970’s: The word “manipulation” is not widely used in the literature
Mobilization/articulation used to separate PT from chiropractic
History of Manipulation:
Key PT’s who stood up for manipulation performed by PT’s

- Freddy Kaltenborn
  - *The Spine*, …Mobilization 1961
  - Nordic approach
  - First to relate manipulation to arthrokinematics

- Geoffrey Maitland
  - “Vertebral Manipulation”, 1964
  - Treats “reproducible signs”
  - Oscillatory techniques (Grades I-V)
History of Manipulation

• Stanley Paris
  – *Spinal Lesion*, 1965
  – Educated PT’s in U.S. in manual therapy
  – Founding member of AAOMPT and first president of the Orthopaedic Section
  – Founder of University of St. Augustine

• Maitland, Kaltenborn, and Paris established long term Manual Therapy education programs for PTs in the USA and abroad
History of Manipulation:
Where do we go from here

• Evidence Based Practice
• Physical Therapists are the leaders in the diagnosis and management of “Movement” Disorders
  • Evidence shows that manipulation and exercise are PTs most useful tools
• Professional Associations promote and protect scope of practice
• Legislation needs to be changed to acknowledge the fact that PT’s can diagnoses.
History of Manipulation:

Summary

• No one profession invented or owns Manipulation

• Traditional Chiropractic is based on unproven theories
  – “Law of the nerve”
  – “Subluxation theory”

• Manipulation has been a vital part of the scope of PT practice since the inception of the profession
Spinal manipulation is not designated as being under the exclusive domain of any one specific profession or group of practitioners.

- Physical therapists, chiropractors, medical doctors, and osteopathic physicians are all educated and trained to employ manipulation within the scope of their respective licenses and in a manner that protects the public's health, safety and welfare.

- It is inappropriate for one profession to attempt to "own" a specific technique or dictate clinical practice through such legislation.

- So why is it so important to the Chiropractic Association to restrict Manual therapy to Chiropractors only?
Movement Receptors

• Vision (information received when moving the head is much greater than when kept stationary)
• Hearing (ball on a racket, walking surface; example blindness)
• Equilibrium organ (gives information about position head in space, otoconia moving in semi circular canals indicating speed and direction)
• Joint receptors
• Tendon receptors
• Muscle spindles
• Skin receptors
## Sensory receptors by type:

<table>
<thead>
<tr>
<th>Type</th>
<th>location:</th>
<th>Fired by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>postural</td>
<td>capsule</td>
</tr>
<tr>
<td>Type II</td>
<td>dynamic</td>
<td>capsule</td>
</tr>
<tr>
<td>Type III</td>
<td>inhibitive</td>
<td>capsule/ligament</td>
</tr>
<tr>
<td>Type IV</td>
<td>nociceptive</td>
<td>most tissues</td>
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</table>
Sensory Receptors

Type 1 receptors (Merkel’s disk receptors in skin, Ruffini endings in joint capsule): Present in the superficial layers of the fibrous joint capsule and skin. They respond to stretch and pressure within the capsule and are slow-adapting receptors with a low threshold. They signal joint position and movement.
Type 2 receptors: (Pacini)

Present in the deep layers of the fibrous capsule. They respond to rapid movement, pressure change and vibration but adapt quickly. They have a low threshold and are inactive when the joint is at rest.
Type 3 receptors: These are present in ligaments. (Comparable with Golgi tendon receptors)

These receptors inform the central nervous system of ligamentous tension, so preventing excessive stresses. The threshold is high and they adapt slowly. They are not active in rest.
Type 4: Free unencapsulated terminals, also called nocisensors

These sensors ramify within the fibrous capsule, adjacent fat pads and around blood vessels. They are thought to signal excessive joint movements and also to signal pain; they have a high threshold and are slow-adapting. The synovial membrane is relatively sensitive to pain due to the absence of these nerve endings.
• All these receptors influence muscle tone via the spinal reflex arcs which are formed by the same nerves that supply the muscles acting on the joint.

• Parts of the joint capsule supplied by a given nerve correspond with the antagonistic muscles.

• Tension given on this part of the capsule produces reflex contraction of these muscles and prevents overstretching of the capsule.
• In consequence, all receptors have an important function in stabilizing and protecting the joint.

• After rupture of joint capsule and ligament, perception is considerably disturbed due to disruption of afferent information.

• For example a sprained ankle shows loss of control of locomotion. Even months after repair of ligamentous and capsular tissues has taken place, perception might still be distorted.
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Grades I & II – often used before & after treatment with grades III & IV
Stress/Strain Curve

Stress-Strain Curve of Collagen Fiber
Grades of mobilization

**Grade I** - Activates Type I mechanoreceptors with a low threshold and which respond to very small increments of tension. Activates cutaneous mechanoreceptors. Oscillatory motion will selectively activate the dynamic, rapidly adapting receptors, ie. Meissner's and Pacinian Corpuscles. The former respond to the rate of skin indentation and the latter respond to the acceleration and retraction of that indentation.

**Grade II** - Similar effect as Grade I. By virtue of the large amplitude movement it will affect Type II mechanoreceptors to a greater extent.
Grades of mobilization

**Grade III** - Similar to Grade II. Selectively activates more of the muscle and joint mechanoreceptors as it goes into resistance, and less of the cutaneous ones as the slack of the subcutaneous tissues is taken up.

**Grade IV** - Similar to Grade III. With its more sustained movement at the end of range will activate the static, slow adapting, Type I mechanoreceptors, whose resting discharge rises in proportion to the degree of change in joint capsule tension.

**Grade V** - This is the same as joint manipulation. Use of the term 'Grade V' is only valid if the joint is positioned near to its end range of motion during joint manipulation. Evans and Breen[2] recently contested this assumption, in fact arguing that an individual synovial joint should be positioned near to its resting, neutral position.
Classifications of mobilization

- Intra rater reliability
- Inter rater reliability
- Allow for repeatability
- Evidence based practice
- To conduct research and measure clinical outcomes
- Will allow for the ability to define optimal treatment regimens for i.e. acute low back pain
• Kalternborn Traction Grading
• Maitland Joint Mobilization Grading Scale
Kalternborn Traction Grading

**Grade I** (loosen)
- Neutralizes pressure in joint without actual surface separation
- Produce pain relief by reducing compressive forces

**Grade II** (tighten or take up slack)
- Separates articulating surfaces, taking up slack or eliminating play within joint capsule
- Used initially to determine joint sensitivity
Kalternborn Traction Grading

Grade III (stretch)
- Involves stretching of soft tissue surrounding joint
- Increase mobility in hypomobile joint
• Grade I traction should be used initially to reduce chance of painful reaction
• 10 second intermittent grade I and II traction can be used
• Distracting joint surface up to a grade III and releasing allows for return to resting position
• Grade III traction should be used in conjunction with mobilization glides for hypomobile joints
  Application of grade III traction (loose-pack position)
  Grade III and IV oscillations within pain limitation to decrease hypomobility
Maitland Joint Mobilization/Oscillations Grading Scale
Grading based on amplitude of movement & where within available ROM the force is applied.

Grade I
Small amplitude movement at the beginning of the range of movement
Used to manage pain and spasm

Grade II
Large amplitude movement within midrange of movement
Utilize when quick oscillation induces spasm or when slowly increasing pain restricts movement halfway into range
Grade III
Large amplitude movement up to point of limitation (PL) in the range of movement
Used when pain and resistance from spasm, inert tissue tension or tissue compression limit movement near end of range

Grade IV
Small amplitude movement at very end of range
Used when resistance limits movement in absence of pain
Distraction Classifications

Grade I: Where the joint surfaces are barely un-weighed
Grade II: Where the slack of the capsule is taken up
Grade III: Where the capsule and ligaments are stretched

Manual Rhythmic: Series of distraction motions, altered with periods of rest
Positional: Most usefull in spine to relive nerve root pressure
Movement Classification

• Classical Movements
  • Active
  • Passive

• Accessory Movements
  • Component movements
  • Joint Play

• Manipulation Movements
  • Distraction
  • Non-Thrust
  • Thrust
Classical Movements

• These are the traditional joint movements

Active Joint movements: Take place within the joint as a result of voluntary muscle action

• Use: Observation of joint range and muscle function

• Passive Movements: Joint motions occurring when a joint is passively moved through it’s ROM
Accessory Movements

• Movements which are essential to normal full range and painfree function and accompany the classical movements

• A Joint Play Motions: Movements not under voluntary control which occur only in response to an outside force. Example: Forward glide of the distal tibia and fibula on the talus during heel strike.

• Use: To detect the joint’s ability to relieve and absorb extrinsic forces
• **B Component Motions**: Motions which take place in a joint complex or related joint to facilitate a particular active motion. Example: glenuhumeral external rotation requires an associated anterior glide of the humeral head. With the knee extension, a component motions is…?

• **Use**: Detect joint dysfunctions in the joint complex or related joint that may be interfering with active motion.
Manipulation Movements

- Manipulations are therapeutic maneuvers applied by the clinician to a joint demonstrating evidence of dysfunction. The techniques are directed toward restoring the arthrokinematics.

- **Distraction**: When two articular surfaces are separated.
- **Use**: To unweigh the surface; to relieve pressure on an intra-articular structure; to stretch the joint capsule or adhesions; to reduce a joint after a dislocation.
Non-thrust: When a joint is oscillated within the limits of an accessory motion or taken to the end of its accessory range and then oscillated or stretched. This group also includes isometric manipulations

Use: Mechanically to elongate the connective tissues including adhesions, neuro-physiologically to fire cutaneous, muscle and/or joint receptor mechanisms

Thrust: A high velocity, short amplitude motion is delivered at the pathological limit of an accessory motion

Use: Alter positional relationships, snap an adhesion, or produce neuro-physiologically effects.
• When the convex surface is fixed and the concave surface moves on it, the concave surface rolls and glides in the same direction.
• When the concave surface is fixed and the convex surface moves on it, the convex surface rolls and glides in opposite directions.
Schools of Thought

Osteopathy
McKenzie
Williams
James Cyriax
Geoffrey Maitland
Ola Grimsby
James Mennel
Brian Mulligan
Kaltenborn
Evjenth
Stanley Paris
Osteopathy
• The founder of osteopathic medicine and surgery was Andrew Taylor Still (1827-1917).
• Still observed through careful study of a patient that when joints are restricted in motion due to mechanical locking or other related causes were normalized, certain disease conditions improved.
• He also made much of the blood and nerve ‘flow’. ‘The Law of the Artery’.
• In his mind, bloodstream is key to health so ‘in order to successfully solve the disease problem or deformity of any kind in every case without exception would find one or more obstructions in some artery or vein’.
Osteopathy

• The rule of the artery is absolute, universal and it must be unobstructed, or disease will result.
• In believing this, Still and colleagues developed a very high degree of manipulative techniques to treat the neuromusculoskeletal system.
• In osteopathy: The body is a unit; structure and function are reciprocally interrelated; the body possesses self regulatory mechanisms for rational therapies based on an understanding of the body unity, the self regulatory mechanisms and the interrelation of structure and function.
• Thomas Walmsley (1927) started to use the term arthrokinematics He noted among other things that the articular surfaces of joint are incongruous except in one special position (Walmsley’s Law)
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Robin A McKenzie
McKenzie Method

• In the 1960s, the physical therapist Robin Anthony McKenzie in New Zealand noted that a subset of his patients experienced significant pain relief when the spine was extended as the part of a treatment. Often, these patients were able to return to normal daily activities.

• Physical therapists who practiced the methods developed by McKenzie founded the McKenzie Institute in 1982

• This modality may be used to treat any number of back, spine, muscle, bone, or joint disorders.

• In order to determine if the McKenzie Method® will relieve a patient's pain or improve their mobility or range of motion, the patient attempts several of the exercises designed to reduce the sensation of pain.
McKenzie Method

• If the pain moves towards the spine or is eliminated, then the patient may be an appropriate candidate for the McKenzie Method®.
• Centralization is the term practitioners of this modality use to describe this movement or elimination of pain.
• The McKenzie Method® classifies musculoskeletal problems that may benefit from this treatment into three categories.
• Usually, if the patient's pain and spinal-related problems do not have a mechanical origin, the McKenzie Method® may not be a useful treatment for that individual.
• Because of the immediate assessment procedures that take place in the first appointment, patients avoid spending money on a procedure that may not benefit them.
Robin Anthony McKenzie

• McKenzie system is one of, if not the most, studied approaches
• The McKenzie Method is not merely extension exercises.
• McKenzie is a comprehensive approach to the spine based on sound principles and fundamentals that when understood and followed accordingly are very successful

• The McKenzie Method: Three Steps To Success:
  • Assessment
  • Treatment
  • Prevention
Assessment:
• Includes a comprehensive and logical step-by-step process to evaluate the patient's problem quickly.
• This mechanical examination can "classify" most patient conditions by the level of pain or limitation that results from certain movements or positions.
• A McKenzie assessment can eliminate the need for expensive and/or invasive procedures.
• Research has shown the initial McKenzie assessment procedures to be as reliable as costly diagnostic imaging (i.e., X-rays, MRIs) to determine the source of the problem and quickly identify responders and non-responders.
McKenzie Method: Treatment

• McKenzie treatment prescribes a series of individualized exercises.
• The emphasis is on active patient involvement, which minimizes the number of visits to the clinic.
• Ultimately, most patients can successfully treat themselves when provided the necessary knowledge and tools.
• For patients with more difficult mechanical problems, a certified McKenzie clinician can provide advanced hands-on techniques until the patient can self administer.
McKenzie Method: Prevention
• By learning how to self-treat the current problem, patients gain hands-on knowledge on how to minimize the risk of recurrence and to rapidly deal with recurrence if it occurs.
• The likelihood of problems persisting can more likely be prevented through self-maintenance.
McKenzie

- McKenzie back extension exercises have been ordered by physicians and prescribed by physical therapists for at least two decades (McKenzie 1981).
- Robin McKenzie noted that some of his patients reported lower back pain relief while in an extended position.
- This went against the predominant thinking of Williams Flexion biased exercises at this period of time.
McKenzie

• The goal of McKenzie exercises is to centralized pain.
• If a patient has pain in the lower back, right buttock, right posterior thigh, and right calf, then the goal would be to "centralize" the pain to the lower back, buttock, and posterior thigh.
• Then, "centralize" the pain to the lower back and buttock, and finally just the lower back.
McKenzie

- McKenzie has developed diagnostic categories that assign patient to specific treatments.
- Patients evaluated by McKenzie certified therapists are most likely to be placed into an extension biased exercise program.
- This is probably why most people think of extension when talking about McKenzie exercises, or because the original exercises were in opposition to Williams' flexion exercises.
Williams (Flexion)

• Dr. Paul Williams first published his exercise program in 1937 for patients with chronic low back pain in response to his clinical observation that the majority of patients who experienced low back pain had degenerative vertebrae secondary to degenerative disk disease (Williams 1937).

• These exercises were developed for men under 50 and women under 40 years of age who had exaggerated lumbar lordosis, whose x-ray films showed decreased disc space between lumbar spine segments (L1-S1), and whose symptoms were chronic but low grade.
Williams (Flexion)

- The goals of performing Williams exercises are to reduce pain and provide lower trunk stability by actively developing the "abdominal, gluteus maximus, and hamstring muscles as well as..." passively stretching the hip flexors and lower back (sacrospinalis) muscles.
- Williams said: "The exercises outlined will accomplish a proper balance between the flexor and the extensor groups of postural muscles..." (Williams 1965, Williams 1937, Blackburn 1981, Ponte et al.).
Williams (Flexion)

• Williams’ flexion exercises have been a cornerstone in the management of lower back pain for many years for treating a wide variety of back problems, regardless of diagnosis or chief complaint.
• In many cases they are used when the disorder’s cause or characteristics were not fully understood by the physician or physical therapist.
• Physical therapists often teach these exercises with their own modifications.
• Williams suggested that a posterior pelvic-tilt position was necessary to obtain best results (Williams 1937).
Williams’ Flexion

• Conceptually, Williams felt that the goal of exercise was to reduce the lumbar lordosis or to flatten the back. (what about the C-spine?)
• To do this, he suggested strengthening the abdominal muscles in order to lift the pelvis from the front.
• In addition, he felt that strengthening the gluteal muscles would pull the back of the pelvis down.
• According to Williams, the combination of these two exercises would accomplish the primary goal of flattening the lumbar curve.
William’s Flexion

- Williams had a series of suggestions for the management of back pain, including what he referred to as "first aid exercises."
- His general exercise protocol included: 1) partial sit-ups; 2) knee-to-chest exercises; 3) hamstring stretches; 4) lunges; 5) seated flexion; and 6) squat.
James Cyriax

- Use selective tension techniques to identify faulty structures in the examination.
- Emphasizes the need for soft tissue massage and frequently uses injection of muscle trigger points.
- Believes the disc is the primary cause of low back pain and uses non-specific spinal techniques designed to move the disc to relieve nerve root pressure.
- Started to use the term cross friction.
- Also known for the term **endfeel**.
Geoffrey Maitland
• Uses primarily passive accessory movements to restore function
• Relies on an extensive assessment based on information from the patient’s subjective examination (history) and the evaluator’s objective assessment.
• The movements are oscillations, the techniques are specific and the goals is what he terms ‘reproducible signs’.
• The Maitland Concept is referred to as a’ concept’ and not as a ‘technique’.
Emphasis is placed not on the technique of treatment but on a basic philosophy- a thought and decision making process, involving analytical examination and assessment on which treatment decisions are based.
Ola Grimsby
• Seeks a scientific rationale for his clinical skill, but puts an emphasis on the art of clinical performance.
• In recognition of the need for scientific verification, it is important to remember that research has little value to us unless it is clinically applicable.
• Consequently, his course do not offer a finished product, but offer you instead, the opportunity to participate in a process of constant development, fostering the development of a lifelong learner.
Ola Grimsby

• Ola Grimsby has received international recognition for his expertise as both a clinician and instructor in orthopaedic manual therapy.
• He graduated from the Norwegian State Physiotherapy School and the Physical Therapy Department of Health in Oslo, Norway.
• He was Norway's first executive member of IFOMPT and a founding member of the American Academy of Orthopaedic Manual Physical Therapy.
• He has authored numerous books and articles in several languages.
James Mennel
• Feels that ‘joint play’ is key to normal function.
• He emphasizes the importance of the small accessory movements as necessary for full movement to occur.
• Techniques are more specific for the extremities than for the spine.
• Was one of the first clinicians to study the intimate mechanics of joints and to adapt mobilizations to his findings.
• E coined the term accessory motion.
Brian Mulligan:
• Mobilization with movement: Nags and snags.
• Concept of mobilizations with movement (MWMS) in the extremities and sustained natural apophyseal glides (SNAGS) in the spine have progressed physical therapist-applied passive physiological movements and accessory techniques in the treatment of musculoskeletal injuries.
• The Physiotherapy treatment of musculoskeletal injuries has progressed from its foundation in remedial gymnastics and active exercise to therapist-applied passive physiological movements and on to therapist-applied accessory techniques.
Brian Mulligan

- Brian Mulligan's concept of mobilizations with movement (MWMS) in the extremities and (SNAGS) in the spine are the logical continuance of this evolution with the concurrent application of both therapist applied accessory and patient generated active physiological movements.
- In the application of manual therapy techniques, Physical Therapists acknowledge that contraindications to treatment exist and should be respected at all times.
- Although always guided by the basic rule of never causing pain, therapist choosing to make use of SNAGS in the spine and MWMs in the extremities must still know and abide by the basic rules of application of manual therapy techniques.
Specific to the application of MWM and SNAGS in clinical practice, the following basic principles have been developed:

- During assessment the therapist will identify one or more comparable signs as described by Maitland.
- These signs may be a loss of joint movement, pain associated with movement, or pain associated with specific functional activities (i.e., lateral elbow pain with resisted wrist extension, adverse neural tension).
- A passive accessory joint mobilization is applied following the principles of Kaltenborn (i.e., parallel or perpendicular to the joint plane).
- This accessory glide must itself be pain free.
Brian Mulligan

• Utilizing his/her knowledge of joint arthrology, the patient is requested to perform the comparable sign (by performing a classic movement)
• The comparable sign should now be significantly improved (i.e., increased range of motion, and a significantly decreased or better yet, absence of the original pain).
• Failure to improve the comparable sign would indicate that the therapist has not found the correct contact point, treatment plane, grade or direction of mobilisation, spinal segment or that the technique is not indicated
• The previously restricted and/or painful motion or activity is repeated by the patient while the therapist continues to maintain the appropriate accessory glide.
• Further gains are expected with repetition during a treatment session typically involving three sets of ten repetitions.
• Further gains may be realised through the application of passive overpressure at the end of available range. It is expected that this overpressure is again, pain-free.
• Successful MWM and Snags techniques should render the comparable sign painless while significantly improving function during the application of the technique.
• Sustained improvements are necessary to justify ongoing intervention.
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Kaltenborn/Evjenth
Kaltenborn/Evjenth

- **Freddy Kaltenborn**: Known for his research in arthrokinematics.
- His techniques incorporate the influence of muscle function and soft-tissue changes in the patient’s manifestation of loss of function.
- The techniques are eclectic and very specific.
Stanley Paris
• Incorporates both chiropractic and osteopathic orientations in his eclectic approach to normalization of arthrokinematics, especially joint play and component motions. As a general rule, the patient is not used to guide the treatment.
• Stabilize vs. mobilize.
• Founded USA
PTA’s and Manual Therapy

So can PTA’s perform Manual therapy techniques?
• Depends on what falls under Manual Therapy
• Depends on the definition of Manual therapy
• Depends on State Practice Act
• Depends on the technique
PTA’s and Manual Therapy

• The APTA's position is they should not, as joint mobilizations require constant reevaluation
• PTA's can legally perform these techniques in most states
• Some PTA programs teach basic joint mobs and other do not citing the APTA's position
• Why can we teach patients to perform self-mobilization techniques but PTA’s cannot?
• Some say PTA’s should only be allowed to perform peripheral joints mobilizations
• Depends on the supervising PT?
• Does CMS differentiate?
PTA's and Manual Therapy

- IAOM (International Academy or Orthopedic Medicine) offers a COMTA for PTA's
- Are all PT’s qualified, just because they are a PT?
- PTA needs to be comfortable with it.
The physical therapist’s scope of practice as defined by the American Physical Therapy Association Guide to Physical Therapist Practice includes interventions performed by physical therapists. These interventions include procedures performed exclusively by physical therapists and selected interventions that can be performed by the physical therapist assistant under the direction and supervision of the physical therapist. Interventions that require immediate and continuous examination and evaluation throughout the intervention are performed exclusively by the physical therapist. Such procedural interventions within the scope of physical therapist practice that are performed exclusively by the physical therapist include, but are not limited to, spinal and peripheral joint mobilization/manipulation, which are components of manual therapy, and sharp selective debridement, which is a component of wound management.
Our opinion (for what it’s worth)
• PTA can bill for the Manual therapy code 97140 since it includes other techniques as well
• Clinically, following the definition “skilled PROM to a joint”, PTA can do Manual Therapy
• It all depends on the clinical education/experience of the operator and the supervising PT.
• A-specific techniques are ok, except for the cervical spine.
• Specific techniques are fine for peripheral joints but should be supervised at first
• Patient safety is key!
• Provide training for your PTA’s
• Have an annual competency check
• Stay involved in the treatment plan
• Performing a MT technique to improve an objective is in my mind the same as performing a specific exercise to improve i.e. the firing pattern of the lumbar multifidus muscles. That will require a reassessment as well.
PTA’s and Manual Therapy

Any thoughts, comments?
The importance of a thorough evaluation

• The concept is very simple here; without a complete and detailed evaluation, you cannot develop an appropriate exercise program.

• This evaluation is ongoing and does not stop after the “initial evaluation” (there is a reason for that name…)

• Understanding the true dysfunction and understanding why that dysfunction exists will put the clinician in the position to address the dysfunction effectively.

• Treat dysfunction/function, not just a symptom such as pain
Arthrology

- Where ever two bones meet, there is a joint
- Bones provide the structural support for joints and the form necessary for joint function
- Bones are covered with articular cartilage wherever they come in contact with another bone
- Bone has a rich blood supply and is richly innervated via its periosteum
- Cortical bone is 5-30% porous.
- Trabecular bone is 30-90% porous
Function of bone:

• Provides a rigid framework to support the body
• Protects viscera
• Stores calcium, magnesium and sodium
• Provides the movable links necessary for motion i.e. joints
• Serves as a point of attachment for muscles, ligaments & viscera
• Shock absorption
Function of cartilage

- Load transmission
- Load dispersion
- Friction reduction
- Minimal shock absorption
Joint Capsule

• The articular capsule creates a closed compartment for synovial joints and defines the intra-articular space.
• Also provides soft tissue support for the joint
• Joint capsules have sensory receptors that are important for proprioception and are believed to be responsible for other effects mediated by joint afferents, including some of the neurophysiological effects of manipulation
<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
<th>Fired by</th>
<th>Example</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type I</strong></td>
<td>Postural</td>
<td>Capsule</td>
<td>Oscillations, graded or progressive</td>
<td>They respond to stretch and pressure within the capsule and are slow-adapting receptors with a low threshold. They signal joint position and movement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Merkel’s disk receptors in skin, Ruffini endings in joint capsule</td>
<td></td>
</tr>
<tr>
<td><strong>Type II</strong></td>
<td>Dynamic</td>
<td>Capsule</td>
<td>Oscillations, graded or progressive</td>
<td>They respond to rapid movement, pressure change and vibration but adapt quickly. They have a low threshold and are inactive when the joint is at rest</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pacini in the deep layers of the fibrous capsule</td>
<td></td>
</tr>
<tr>
<td><strong>Type III</strong></td>
<td>Inhibitive</td>
<td>Capsule, Ligament</td>
<td>Stretch or sustained pressure thrust</td>
<td>These receptors inform the central nervous system of ligamentous tension, so preventing excessive stresses</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Comparable with Golgi tendon receptors, present in ligaments</td>
<td></td>
</tr>
<tr>
<td><strong>Type IV</strong></td>
<td>Nociceptive</td>
<td>Most Tissues</td>
<td>Injury &amp; Inflammation</td>
<td>They are thought to signal excessive joint movements and also to signal pain</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Free unencapsulated terminals, also called nocisensors</td>
<td></td>
</tr>
</tbody>
</table>
Function of Joint Capsule

• Provides a defined joint space
• Contains synovial fluid
• Maintains the volume and sometimes the vacuum of the joint thus helping provide stability
• Serves as a site for mechanoreceptors function
• Helps guide movement
• Helps restrict excess motion
Anatomy

• One will need to have a knowledge of surface and movement anatomy to be able to identify normal and abnormal anatomy and the impact thereof on movement
• We will not review anatomy during this course
Rules for mobilization/manipulation

- Direction of force: Perpendicular to the concave joint space for distraction; parallel to the concave joint surface for glide.
Rules for mobilization/manipulation

• Patient relaxed with the joint supported
• Examiner must appear relaxed
• Locate the joint line
• One hand stabilizes
• One hand manipulates
• Bunch up skin when feasible
• Do not squeeze or block
• One joint at a time, into one direction
• Manipulate in accessory motion, not classical
• Position/start in LPP
• Manipulate parallel or perpendicular
• No forceful movement
Indications for Manual therapy/Mobilization

• Any painful joint to provoke neurophysiological effects (reduce pain/protective muscle splinting)
• Any stiff joint for the mechanical benefits
• These are the only two indications for manual therapy
Technique selection

• **High Tissue Reactivity**: Pain before resistance → Oscillations, no stretching

• **Moderate Tissue Reactivity**: Pain synchronous with resistance → Oscillations, stretches, oscillations

• **Low Tissue Reactivity**: resistance before pain → stretches and/or thrust
Contra Indications for Manual therapy/Mobilization

There are no absolute contra-indications, but techniques selection is rather important, especially for high velocity thrust techniques.
Precautions

• Certain disease states
• Hemarthrosis, especially when you are not sure whether you are dealing with a synovitis or a hemarthrosis
• Muscle holding
• When in doubt, don’t
• Hypermobility
• Acute inflammation (gout)
• Joint replacement
• Anti-coagulant therapy
Precautions

Prior to Manipulation:
• Adequate evaluation
• Identify the direction of the restriction
• Prepare the soft tissues
• Protect any neighboring hypermobility

Structural inspection of posture and bony position/landmarks are key prior to determining the cause of the restriction
Joint PROM and Endfeel

Classical motion:
   Joint Range
   Endfeel

Accessory motion
   Grading of motion (Paris)
   0   Ankylosing
   1   Considerable restriction: Hypo
   2   Slight Restriction       Hypo
   3   Normal
   4   Slight Increase         Hyper
   5   Considerable increase   Hyper
   6   Unstable
Endfeel

• Quality of resistance that limit ROM
• End feel will be different per joint, depending on the structure restricting the ROM
• PROM is always greater than AROM
• Compare to the other side if possible
• To restore normal classical movement, normal endfeel should be restored as well
• Types include soft tissue, muscular, ligamentous, cartilaginous, capsular
Effects of manipulation

- Psychological
- Neurophysiological
- Biomechanical
- Chemical
Psychological effects

• Induced movement
• Pop or snap

Neurophysiological effects

• Gate control
• Movement and nutrition (spine/disc)
• Centralization of pain
Biomechanical effects:

- Stretch restrictions within the capsule
- Stretch or snap adhesions between capsule and bone ends

Chemical effects:

- Release of endorphins following multiple level thrust manipulations
- Type III receptor activation (GTO) results in muscle relaxation
- The Pop (Nitrogen in vacuum)
Arthrokinematics

Closed packed position
- Joint surfaces are incongruous except in one special position
- Locked and screwed
- Statically efficient for load bearing
- Dynamically dangerous

Loose packed position
- Opposite of CPP
- Capsule and ligaments are at their slackest
- Unlocked
- Statically inefficient for load bearing
- Dynamically safe
<table>
<thead>
<tr>
<th>Joint</th>
<th>Position/Range</th>
<th>Freely mobile Joints</th>
<th>Range of Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facet (Spine)</td>
<td>Midway between flexion and extension</td>
<td>MCP</td>
<td>Slight Flexion</td>
</tr>
<tr>
<td>TMJ</td>
<td>Mouth slightly open</td>
<td>IP</td>
<td>Slight Flexion</td>
</tr>
<tr>
<td>Glenohumeral</td>
<td>55 degrees abduction, 30 degrees horizontal adduction</td>
<td>Hip</td>
<td>30 degrees flexion, 30 degrees abduction, slight lateral rotation</td>
</tr>
<tr>
<td>AC</td>
<td>Arm resting by side in normal physiological position</td>
<td>Knee</td>
<td>25 degrees flexion</td>
</tr>
<tr>
<td>Ulnohumeral (elbow)</td>
<td>70 degrees flexion, 10 degrees supination</td>
<td>Talocrural (ankle)</td>
<td>10 degrees plantar flexion, midway between maximum inversion and eversion</td>
</tr>
<tr>
<td>Radiohumeral</td>
<td>Full extension, full supination</td>
<td>Subtalar</td>
<td>Midway between extremes of ROM</td>
</tr>
<tr>
<td>Proximal Radioulnar</td>
<td>70 degrees flexion, 35 degrees supination</td>
<td>Midtarsal</td>
<td>Midway between extremes of ROM</td>
</tr>
<tr>
<td>Distal Radioulnar</td>
<td>10 degrees supination</td>
<td>Tarsometatarsal</td>
<td>Midway between extremes of ROM</td>
</tr>
<tr>
<td>Radiocarpal (wrist)</td>
<td>Neutral with slight ulnar deviation</td>
<td>Metatarsophalangeal</td>
<td>Neutral</td>
</tr>
<tr>
<td>Carpometacarpal</td>
<td>Midway between abduction/adduction and flexion/extension</td>
<td>Interphalangeal</td>
<td>Slight Flexion</td>
</tr>
</tbody>
</table>
Convex – Concave considerations

• All joint surfaces are either convex or concave
• Convex is male, concave is female
• Convex has more cartilage at the center and concave at the edges
• Even flat joint will have convexity; cartilage may make the difference
• Where surfaces appear to be flat, the larger one will be considered male (convex)
Convex – Concave considerations

• Joint motion is either a roll a slide or a long – axis rotation and often a combination
• I.e.: when the knee moves into extension, the femur rolls and slides on the tibia. Depending on WB of the knee, roll and glide will happen in the same or opposite direction
• There are some common rules that you should understand before you start mobilizing peripheral joints
Convex – Concave considerations

• If a convex surface is moving relative to a concave surface, roll and slide must occur in the opposite direction. So a manipulation force of slide would be applied in the opposite direction to the movement of the limb.
• If a concave surface moves on a convex surface, roll and slide occur in the same direction. So a manipulation force of slide must be applied in the same direction as the movement of the limb.
• These Convex/Concave rules only apply to component motions and not to joint play.
The Spine
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Spinal Anatomy, a review

• Osseous anatomy and arthrology
• Ligamentous anatomy
• Muscular anatomy
• The intervertebral disc
• Osteokinematics and body mechanics
Bone Functions
• Provides a rigid framework to support the body
• Protects viscera
• Stores calcium, magnesium and sodium
• Provides the movable links necessary for motion i.e. joints
• Serves as a point of attachment for muscles, ligaments and viscera
• Shock absorption
The Spinal Column

- In general 33 vertebrae
- The sacral vertebrae are fused
- 25 mobile segments
- 4 curves: cervical lordosis, a dorsal kyphosis, a lumbar lordosis, and a sacral kyphosis.
Spinal Osseous anatomy and arthrology

Sacralization

Fusion of the fifth lumbar vertebra to the sacrum
Lumbarization

Sacral development of the fifth lumbar vertebra
The Spinal Column

1. The function of the curves is to increased the load bearing capacity of the spine.
2. With the correct curves, the load bearing capacity is 10 times greater than that of a straight spine.
3. The curves are formed by the shapes of the vertebral bodies and their interposed intervertebral, discs.
4. In the cervical region, the discs are thicker anteriorly producing the cervical lordosis. Within the thoracic region each disc is uniform in height and the thoracic curvature is due primarily to the shapes of the vertebral bodies.
The Spinal Segment

- Defined as “the adjacent halves of two vertebrae, the disc between them and the related contents of the spinal canal and intervertebral foramen”.
- It also includes the ligaments, facet joints, muscles, skin and fascia that relate to that particular level.
- Also call the “functional unit” of the spine.
The Vertebra

Each vertebra has multiple processes and surface markings for numerous ligamentous attachments and tendinous structures.

Vertebrae will differ per region.

A vertebra consists of 2 portions: the body and the neural arch. Together these portions form a foramen occupied by the spinal cord meninges and associated vessels.

The body is kidney shaped. Its upper and lower surfaces are slightly concave for the attachment of the endplate of the vertebral disc. The body is convex from side to side. On the posterior aspect of the boy is the large
The function of the vertebral body.
- Transmits body weight
- Provides a flexible structure upon which muscle can act.
- Provides attachment for the muscular processes
- Also limits the range of motion
- Absorbs shock (more so than the disc!). The body is actually the cushion and not the disc when the motion segment is compressed (Paris, 1965).
- The disc is responsible for the equalization and distribution of stress applied across the segment but not for its absorption.
Spinal Osseous anatomy and arthrology

The pedicle

• Short, stout process which projects from the posterior lateral aspect of the vertebral body to unite with the lamina.

• On the superior and inferior surfaces there are vertical notches which in the articulated spine, form with the notches of adjacent vertebrae the intervertebral foramina for the passage of the spinal nerves, veins arteries and lymphatics.

The lamina

• These are broad, flat plates that extend from the pedicle to unite posteriorly.
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Spinal Osseous anatomy and arthrology

- Spinal canal
- Lamina
- Pedicle
- Spinal nerve

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Spinal Osseous anatomy and arthrology

The articular processes.

These arise form the junction of the pedicle with the lamina and are 4 in number. A superior pair and an inferior pair. Each process bears a facet for articulation with a corresponding facet of the adjacent vertebra to form the interzygopophyseal joints/facet joints.

The muscular processes

• For the attachment of muscles and ligaments
• Serve a protective function against direct trauma.
• Transverse process
• Spinous process
1. Vertebral body
2. Vertebral foramen
3. Spinous process
4. Pedicle
5. Superior articular process
6. Transverse process
7. Lamina
Variety in vertebra

There are significant difference between vertebrae from different regions. Let’s take a close look:

- Cervical vertebra
- Thoracic vertebra
- Lumbar vertebra
Spinal Osseous anatomy and arthrology

Cervical vertebra

**Atlas** (because it supports the globe of the head)
- 1st vertebra
- Anterior arch is narrow
- TP’s are prominent lateral
- Transverse foramen for vertebral artery
- No vertebral body
- Articular surfaces are horizontal

**Axis** (it forms the pivot upon which the first vertebra rotates)
- Narrow spinous process
- Inferior articulating surfaces are more angled from the horizontal plane
- Odontoid process to center rotation and origin for alar ligament
What is wrong here?
And here?
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And here?
And here?

Odontoid process fracture. The small fragment is rotated anteriorly and superiorly. Portions of the ruptured cruciate ligament and of the rectorial membrane are entrapped in the wide fracture gap.
The 7\textsuperscript{th} cervical vertebra
- Prominent spinous process (vertebra prominens)
- SP is not bifurcated, but terminating in a tubercle to which the lower end of the ligamentum nuchae is attached

Other cervical spine vertebra characteristics.
- Small vertebral body
- The anterior and posterior surfaces are flattened and of equal depth
- The pedicles are directed lateral ward and backward
- The laminae are narrow, and thinner above than below
- The spinous process is short and bifid
- The transverse processes are each pierced by the foramen transversarium, which, in the upper six vertebrae, gives passage to the vertebral artery and
Thoracic vertebra

- Intermediate in size
- They increase in size as one proceeds down the spine
- Distinguished by the presence of facets on the sides of the bodies for articulation with the heads of the ribs
- The pedicles are directed backward and slightly upward
- The laminae are broad, thick
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Spinal Osseous anatomy and arthrology

Scotty Dog

Muscle forces

Gravity

Forward slippage of vertebrae

[Diagram of spinal osseous anatomy and arthrology with Scotty Dog illustration]
Spinal Osseous anatomy and arthrology

1. Pedicle (right)
2. Superior articular process (right)
3. Pars interarticularis / isthmus (right)
4. Lamina (right)
5. Inferior articular process (right)
6. Transverse process (right)
7. Spinous process
8. Intervertebral disc
9. Interlaminar space
10. Transverse process (left)
11. Inferior articular process (left)
12. Superior articular process (left)
13. Lamina (left)
14. Vertebral body
Thoracic vertebra
- The vertebral foramen is small, and of a circular form.
- The spinous process is long, triangular on coronal section, directed obliquely downward.
- The articular facets are practically flat and are directed backward and a little lateral ward and upward.
- The transverse processes arise from the arch behind the superior articular processes and pedicles; they are thick, strong, and of considerable length, directed obliquely backward and lateral ward.
The lumbar vertebrae are the largest segments of the movable part of the vertebral column, and can be distinguished by the absence of a foramen (hole) in the transverse process, and by the absence of facets on the sides of the body.

- each lumbar vertebra consists of a *vertebral body* and a *vertebral arch*
- The vertebral body of each lumbar vertebra is large, wider from side to side than from front to back, and a little thicker in front than in back.
- The pedicles increase in angulation in the axial plane from 10 degrees to 20 degrees by L5
- The laminae are broad, short, and strong
Lumbar vertebra

The **fifth lumbar vertebra** is characterized by its body being much deeper in the front than behind, which accords with the prominence of the sacro-vertebral articulation.

- Smaller size of its spinous process
- Wide interval between the inferior articular processes
- Thickness of its transverse processes, which spring from the body as well as from the pedicles.
- The fifth lumbar vertebra is by far the most common site of spondylolysis and spondylolisthesis.
Spinal Osseous anatomy and arthrology

Iliolumbar/lumbosacral ligament

- The iliolumbar ligament is attached above to the lower and front part of the transverse process of the fifth lumbar vertebra.
- It radiates as it passes lateralward and is attached by two main bands to the pelvis.
- The lower bands run to the base of the sacrum, blending with the anterior sacroiliac ligament.
- The upper is attached to the crest of the ilium immediately in front of the sacroiliac articulation, and is continuous above with the lumbodorsal fascia.
Iliolumbar ligament (continued)

- In front, it is in relation with the Psoas major; behind, with the muscles occupying the vertebral groove; above, with the Quadratus lumborum.
- Anchors the spine to the pelvis.
- This ligament begins life as a muscle and changes to a ligament until the twenties and completes its transition by age forty.
- This has implications for stability and mobility.
- In males, this ligament goes from TP L5 to the superior aspect of the SI joint.
- In females, this ligament arises from L5 AND L4!!!
- Again, major implications for stability/mobility!
- Clinically it is men, approximately 19:1(5%) that have the phenomenon of lateral shift (because of this lig.).
Alar Ligament
Alar ligament (Continued)

- The alar ligaments connect the sides of the dens (on the axis, or the second cervical vertebra) to tubercles on the medial side of the occipital condyle.

- They are short, tough, fibrous cords that attach the skull to C1 vertebra and function to check side-to-side movements of the head when it is turned.

- The alar ligament is also known as the "check ligament of the odontoid."

- Injuries such as rupture and overstretching of the alar ligaments is often caused through whiplash during car accidents. If a patient describes prolonged symptoms after a traumatical situation, medical workers should think about ligamental damages.
Function of the facet joint:
- To permit, guide and limit motion within the segment.
- Keep in mind that all movements also involve the disc.
- The directions of the permitted motions are determined by the shape and direction of the facet joints.
The Facet Joint

- These joints are formed by the superior and inferior articular processes arising from the vertebral arches of the adjacent vertebrae.
- Planes of motion vary per region, affecting the regional mobility and ROM.
Spinal Osseous anatomy and arthrology

### Spinal Movements

<table>
<thead>
<tr>
<th>Segmental ROM</th>
<th>FB/BB</th>
<th>SB</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/O</td>
<td>13</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>A/A</td>
<td>13</td>
<td>10</td>
<td>38</td>
</tr>
<tr>
<td>C2/3</td>
<td>10</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>C3/4</td>
<td>15</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>C4/3</td>
<td>17</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>C5/6</td>
<td>12</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>C6/7</td>
<td>12</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>C7/T1</td>
<td>4</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>T1/2</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>T2/3</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>T3/4</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
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<td>2.5</td>
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<td>2.5</td>
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<td>2</td>
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</tr>
<tr>
<td>T7/8</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
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<td>5</td>
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</tr>
<tr>
<td>T9/10</td>
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<td>T10/11</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>T11/12</td>
<td>7</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>T12/L1</td>
<td>9</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>L1/2</td>
<td>9</td>
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<td>11</td>
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<tr>
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<td>11</td>
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<tr>
<td>L4/5</td>
<td>12</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>L5/S1</td>
<td>10</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Spine (mobility) tests

Palpation: **Condition, Position, Mobility**
Cervical Spine: Flexion, Extension, Rotation, Side bending
First rib
Thoracic Spine: Flexion, Extension, Rotation, Side bending
Lumbar Spine: Flexion, Extension, Rotation, Side bending
C0-C1-C2 Complex
Upper cervical spine vs. mid cervical spine
**ALWAYS PERFORM VERTEBRAL ARTERY TEST PRIOR TO C-SPINE MONILIZATIONS!**
The Hand

Metacarpophalangeal joints

- Movement: Flexion, extension
- LPP: 10-20 degrees flexion
- Component motions:
  - Dorsal glide
  - Volar glide
  - Radial glide
  - Ulnar glide
  - Daorsal tilt with flexion beyond 65
MCP Flexion mobilizations

• Distraction
• Long Axis Rotation
• Volar Glide
• Radial Glide
• Ulnar Glide
• Dorsal Tilt
• Ulnar Tilt
• Radial Tilt
MCP Extension mobilizations

- Distraction
- Dorsal Glide
- Radial Glide
- Ulnar Glide
- Long Axis Rotation
- Ulnar Tilt
- Radial Tilt
PIP and DIP flexion mobilization

• Distraction
• Volar Glide
• Four unicondylar glides
• Radial tilt
• Ulnar tilt
PIP and DIP extension mobilization

• Distraction
• Dorsal Glide
• Four unicondylar glides
• Radial tilt
• Ulnar tilt
PIP/DIP note: Radial and Ulnar glides are not performed in PIP and DIP because of the pseudo bicondylar articular surfaces. Also, long axis rotation is not performed either, but rather AP/PA glides of the medial and lateral compartment.
The Wrist

• In this course we will assess the carpal bones as a distal and proximal row rather than each carpal bone by itself.
• **Movement:** Flexion (with extension, adduction, abduction, supination, pronation)
• **LPP:** Radiocarpal, midcarpal, intercarpal,
  CMC: 0 or 20 degrees of flexion, or extension
• **Component motions:** Volar glides, dorsal glides, distraction
• Capitate is main landmark and is center of movement
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Wrist extension

• Distal row moves dorsal, proximal row moves volar up to 60 degrees.
• At 60 degrees, hamate, capitate, trapezoid and scaphoid come into CPP, forcing radial deviation
• When a blow is taken to the hand in extension, the force is generally taken via the third metacarpal to the capitate to lunate then to the radius
Wrist flexion

• The opposite occurs
• There is considerable shift of the radius moving caudally
• Last 30 degrees of flexion is mainly distal row movement

• Mobilization; Convex on concave, or vv.? Flexion vs. extension
• Distraction: Hand in pronation, volar side down
The Wrist

• Distal row is conspired convex on the proximal side
• Proximal row is considered concave at the distal side and convex on the proximal side
• The distal aspect of the radius/ulna are considered concave

• **Mobilization**: Convex on concave, or vv.? Flexion vs. extension
• **Distraction**: Hand in pronation, volar side down
The CMC joint

- Metacarpophalangeal joint
- Carpo-metacarpal joint
- Trapezium
- Thumb metacarpal
CMC Joint

**Motion:** Flexion, extension, abduction, adduction

**Component motions:**
- Palmar Glide Across Palm, parallel to palm (Flexion),
- Palmar Glide into Palm, right angles to palm (Abduction)
- Triquetral Volar Glide (Supination)
- Distal Radius- ulna Volar Glide of Ulna (Pro/Sup/Ext/Flex (wrist+Elbow))
Other wrist techniques:

- Radiocarpal Volar Glide: Wrist extension
- Radiocarpal Medial Glide: Wrist abduction (radial deviation) (may use wedge)
The Knee

Joints:
• Patello Femoral
• Tibia Femoral
• Tibia Fibula

Movements:
• Flexion and extension of tibia on femur
• Medial and lateral rotation of tibia on femur

**LPP:**
PFJ: 0-5 degrees
Tib-fib: 10-20 degrees flexion
The Knee

Component motions:
• Moving into extension with foot off the ground (open chain)
• Moving into flexion with foot off the ground (open chain)

Joint play motions:
**PFJ:** transverse axis rock
longitudinal axis rock
medical lateral glides
The Knee

Joint play motions:

**Tibia Femoral**
- Distraction
- Medial, lateral tilts

**Tibia Fibula**
- anterior/lateral glide
- posterior/medial glide
- superior, inferior glides
Mobilizations to improve Knee flexion

**PFJ:** Inferior glide
Medial glide
Lateral glide
transverse axis rock
longitudinal axis rock

**Tib-Fem:** Distraction
Posterior glide
Anterior glide lateral condyle
Posterior glide medial condyle
Anterior tilt
Medial tilt
Lateral tilt
Mobilizations to improve Knee flexion

**Tib-Fib**
- Posterior/medial glide
- Anterior/lateral glide
- Inferior glide
- Superior Glide
Mobilizations to improve Knee extension

**PFJ:** Superior glide
Medial glide
Lateral glide
transverse axis rock
longitudinal axis rock

**Tib-Fem:** Distraction
Anterior glide
Posterior glide lateral condyle
Anterior glide medial condyle
Medial tilt
Lateral tilt
Mobilizations to improve Knee flexion

**Tib-Fib**
- Posterior/medial glide
- Anterior/lateral glide
- Inferior glide
- Superior Glide
Mobilizations to improve Tibia IR

PFJ: Superior glide
Medial glide
Lateral glide
transverse axis rock
longitudinal axis rock

Tib-Fem: Distraction
Anterior glide lateral condyle
Posterior glide medial condyle
Medial tilt
Lateral tilt

Tib-fib: Same as for flex/ext.
Mobilizations to improve Tibia IR

**PFJ:** Superior glide
Medial glide
Lateral glide
transverse axis rock
longitudinal axis rock

**Tib-Fem:** Distraction
Anterior glide lateral condyle
Posterior glide medial condyle
Medial tilt
Lateral tilt

**Tib-fib:** Same as for flex/ext.
Mobilizations to improve Tibia ER

**PFJ:** Superior glide
Medial glide
Lateral glide
transverse axis rock
longitudinal axis rock

**Tib-Fem:** Distraction
Posterior glide lateral condyle
Anterior glide medial condyle
Medial tilt
Lateral tilt

**Tib-fib:** Same as for flex/ext.
The foot ankle complex

Joints:

• Talocrural
• Subtalar
• Midtarsal
The foot ankle complex

Talocrural:
Active movements: Dorsiflexion, plantarflexion
LPP: 5-10 degrees plantarflexion

Component motions:
Dorsiflexion:
• Posterior glide and medial glide of talus
• Superior movement of the fibula

Plantarflexion:
• Anterior glide and lateral glide of talus
• Inferior movement of fibula
Joint play Motions for the ankle

• Talus distraction
• Spreading apart of tibia – fibula
• Anterior/lateral glide of fibula head
• Posterior/medial glide fibula head
Joint Mobilizations for the ankle

Ankle dorsiflexion: Talocrural
- Distraction talus
- Posterior glide talus
- Medial glide talus
- Anterior glide distal tibia
- Superior motion fibula
- Ant/lat glide fibula head
- Post/med glide fibula head
Joint Mobilizations for the ankle

Ankle plantar flexion: Talocrural

- Distraction talus
- Anterior glide talus
- Lateral glide talus
- Posterior glide distal tibia
- Inferior motion fibula
- Anterior/lateral glide fibula head
- Post/med glide fibula head
The Hip

Active movements: Flexion, extension, adduction, abduction, IR/ER

LPP: 30° flexion, 30° ABD, little ER

Component motions: Posterior glide, anterior glide, inferior glide
Hip Joint Mobilization

**Flexion:**
- Distraction
- Posterior stretch
- Inferior glide beyond 70° flexion

**Extension:**
- Distraction
- Anterior stretch

**Adduction:**
- Distraction
- Lateral stretch

**Abduction:**
- Distraction
- Medial stretch
Hip Joint Mobilization

Internal rotation:
• Distraction
• Posterior stretch

External rotation:
• Distraction
• Anterior stretch
The Shoulder

For this course we will only discuss the glenohumeral joint

**Active movements:**
- Sagittal flexion and extension
- Coronal adduction and abduction
- Scapulohumeral elevation
- Internal, external rotation

**LPP:** 20 degrees scapulohumeral abduction (20 degrees horizontal abduction)
The Shoulder

Component motions:
• Inferior and posterior glide with sagittal flexion
• Anterior glide with extension
• Inferior and anterior glide with coronal abduction
• Inferior glide with scapulohumeral elevation
• Posterior glide with internal rotation
• Anterior glide with external rotation

Joint play Motions:
• Lateral Distraction
Glenohumeral mobilizations

**Abduction/Flexion**
- Lateral distraction
- Inferior glide

**External Rotation:**
- Lateral distraction
- Anterior glide

**Internal Rotation:**
- Lateral distraction
- Posterior glide

**Horizontal adduction:**
- Lateral distraction
- Posterior glide
Glenohumeral mobilizations

**Horizontal Abduction**
- Lateral distraction
- Anterior glide

**Sagittal Flexion:**
- Lateral distraction
- Inferior glide
- Posterior glide

**Extension:**
- Lateral distraction
- Anterior glide

**Coronal Abduction:**
- Lateral distraction
- Inferior glide
- Anterior glide
References:
• The McKenzie Institute:
  • *Introduction to Spinal Evaluation, S1, USA*
  • [http://www.mckenziemdt.org/method.cfm](http://www.mckenziemdt.org/method.cfm)
  • *Introduction to extremity evaluation, E1, USA*