Joint as a Reference to Assessment and Treatment of the Musculoskeletal System

on the invitation of
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Outline

• Assessment of joint mobility
  • Osteo-kinematics
  • Arthro-kinematics
  • Treatment plane
  • Joint Surfaces
  • ‘Grades’ of motion

• Joint mobilization as an intervention
  • Indications, Benefits, Contraindications
  • Direction, Grade, Speed

Assessment of joint mobility

• Osteo-kinematics
  Movement of a bone around an axis. Rotation.

• Arthi
• Trea
• Joini
• Grac
Osteo-kinematic Motions at the Knee

• Examples ....

Assessment of joint mobility

• Osteo-kinematics
  Movement of a bone around an axis. Rotation.

• Arthro-kinematics
  Movement of a bone at the joint. Linear motion.

Arthro-kinematic Motions at the Knee

Which arthrokinematic motions are not represented in these photos?
Assessment of joint mobility

- Osteo-kinematics
  - Movement of a bone around an axis.
    - Rotation.
- Arthro-kinematics
  - Movement of a bone at the joint.
    - Linear motion.
- Treatment plane
  - An imaginary plane parallel to the concave joint surface.

Joint Surfaces

- Concave and Convex

Grades of motion
Passive Motion

Joint Accessory Motion Testing

Joint Play Testing

Pioneers of Joint Play Testing

• The two principal pioneers of joint play testing in manual therapy are Geoffrey Maitland of Australia, and Freddy Kaltenborn of Norway.
• Both individuals developed techniques for the extremities and spine, and both developed different scales for describing the force and movement used during testing and treatment.

Essential Differences Between the Australian and the Nordic Approach

• During the development of his approach, Maitland was strongly influenced by the neurophysiologic principles relating to pain.

• Kaltenborn on the other hand was influenced by the joint based mechanical approaches advocated by Cyriax, Mennel, and Stodard.
Maitland’s Approach to Joint Play Testing

- Maitland’s joint play testing uses both rotational and translational movement within a joint.
- These movements are performed in an oscillatory manner (1 and 2-3 oscillation per second)
- The examiner feels for abnormal resistance to motion and carefully monitors any symptoms reported by the patient.

Maitland’s 5 Point Scale

- Maitland developed a 5 point scale to describe the amount (amplitude) of movement and of the oscillations used during manual joint testing and treatment.

Grade 1 – a small amplitude movement at the beginning of the movement
Grade 2 – a large amplitude movement performed within the free range but not moving into any resistance (perceived stiffness)
Grade 3 – a large amplitude movement performed up to the limits of the range
Grade 4 – a small amplitude movement performed at the limit of the range
Grade 5 – a small amplitude movement performed beyond the limit of the range (a manipulation)
Kaltenborn’s Approach to Joint Play Testing

- In contrast to Maitland, Kaltenborn developed his joint play testing with an emphasis on straight line, translatory, movement within a joint.
- This testing is not truly oscillatory although it is often repeated several times using different speeds of movement.
- The examiner feels for abnormal resistance to motion with a particular emphasis on end-feel testing.

Kaltenborn’s 3 Point Scale

- Kaltenborn developed a 3 point scale to describe the amount of movement and perceived resistance during manual joint testing and treatment.

Kaltenborn’s Grades

- A Grade I “loosening” movement is an extremely small traction force which produces no appreciable increase in joint separation. Grade I traction nullifies the normal compressive forces acting on the joint.
- A Grade II “tightening” movement first takes up the slack in the tissue surrounding the joint and then tightens the tissues.
- A Grade III “stretching” movement is applied after the slack has been taken up and all tissues become taut.
Angular Joint Play Testing

- Maitland’s approach uses angular motions in the extremities when looking at joint play.
- Logically, angular movements of the long bones may be used to identify abnormal resistance due to muscle guarding, muscle tone, or articular restriction.
- However, because of its gross nature, it is difficult to judge whether articular or neuromuscular impairments are causing a particular movement restriction.

Translatoric Joint Play Testing

- Drawing from simple mechanical principles Kaltenborn reasoned that there are two types of movement available in a joint: rolling and gliding.
- Understanding that excessive loading (sheer and compression) leads to articular cartilage degeneration Kaltenborn chose to emphasize straight-lined, translational (gliding) movements during joint examination, mobilization, and manipulation.
- His techniques are performed using very small amplitudes of movement with forces applied close to the joint line.

Kaltenborn & Maitland’s Initial Treatment Directions

- Kaltenborn and Maitland target their initial treatments differently.
- Maitland advocated treating patients with pain by directing oscillations towards the direction of movement causing pain (but not into pain).
- Kaltenborn on the other hand emphasized treating to improve function using directions that cause the least amount of pain.
Combining Scales of Movement

- The scales developed by Maitland and Kaltenborn are equally dissimilar.
- Kaltenborn’s scale looks at resistance within the range while Maitland’s scale looks at the amplitude of oscillations within the range.
- Some manual therapy systems integrate these two scales which causes confusion for the novice manual therapist.

Which Scale Will We Use?

- For the sake of study here, we will use the scale as developed by Kaltenborn.
- We will describe the use of oscillations during treatment later in this course.

Palpating Resistance to Normal Movement

- As the therapist takes up the slack in the tissues they will feel an increased resistance to movement as they near the first stop. This resistance may develop quicker or slower, and may be firmer or softer dependent on the specific anatomy of the joint and pathology it may be experiencing.
Identifying Pathological Movement

- When abnormal movement is present the first and final stops to the movement will change.
- For the hypomobile joint the stop will occur sooner.
- For the hypermobile joint the stop will occur later.

The Relationship of Resistance to Pathological Movement

- The shift in the first and final stops is accompanied by a shift in the resistance felt by the therapist.
- Resistance to movement will continue to increase as the therapist nears these stops regardless of where they are located in the range of movement.

Manual Grading of Movement

- In order to communicate with each other regarding our joint play findings it is useful to use this simple 6 point scale.

  0 = No movement (ankylosis)
  1 = Considerable decreased movement
  2 = Slight decreased movement
  3 = Normal
  4 = Slight increased movement
  5 = Considerable increased movement
  6 = Complete instability
Determining the Direction of Decreased Joint Gliding

- The direction of limitation for joint gliding may be determined either directly (using glide testing) or indirectly using Kaltenborn’s Concave-convex rule.

The Direct Method (Glide Testing)

- Passive translatory gliding movements are applied in all possible directions to determine joint gliding restrictions.
- *This is the preferred method as it gives the most information about the degree and nature of gliding restrictions!*

The Indirect Method (Concave-Convex Rule)

- This method is based on the relationship between normal bone rotations and the gliding component of the corresponding joint movement.
- Useful for joints with very small movement.
- Useful when severe pain limits movement.
Applying the Concave-Convex Rule

- For the convex joint partner
  - The therapist moves a bone with a convex joint surface opposite to the direction of the restricted bone movement.

- For the concave joint partner
  - The therapist moves a bone with a concave joint surface in the same direction of the restricted bone movement.

End-feel

- End-feel is the sensation imparted to your hands at the limit of available range of movement.
- End-feel can be evaluated during standard and combined passive rotational movements (overpressure end-feel) or during translatorial joint play movements (joint play end-feel).

The Background of End-feel Testing

- The first individual to describe end-feels was James Cyriax.
  - He described 5 primary end-feels:
    - Capsular
    - Bony
    - Soft
    - Boggy
    - Empty
Other Descriptions of End-feels

- Many others have described end-feels.
- In fact Paris has approximately 21 end-feels which he has described.
- Kaltenborn describes 3 normal end-feels based on his study with Cyriax
  - Firm or Capsular
  - Hard or Bony
  - Soft

Normal End-feels

- **Soft**
  - Characteristic of soft tissue approximation (e.g., knee flexion) or soft tissue stretching (e.g., ankle dorsiflexion with the knee extended)
- **Firm**
  - Characteristic of capsular or ligamentous stretching.
  - A firm endfeel is variable among individuals depending on factors such as size, age, and the extent of degenerative changes.
- **Hard**
  - Occurs when bone or cartilage meet (e.g., elbow extension and flexion)

Judging the End-feel

- There are normal end-feels associated with specific joints. These end-feels are expected to occur at the end of normal ROM.
- An end-feel is considered abnormal when it is different than the normal occurring end-feel for the joint, and when it occurs at a different point in the range than is normal.
Shoulder Examination -- Let’s Practice

Glenohumeral Joint Play Testing
Positioning the Joint for Testing

- When initially positioning the joint for joint play testing we use either the resting or actual resting positions.
- Resting positions were first described by McConaill and are an estimate of where the joint capsule is the most relaxed, there is little joint contact, and there is the greatest joint play.

The Actual Resting Position

- Sometimes we are unable to test our patients joint in the resting position due to pain or significantly limited motion.
- In these cases we use the position where there is the least amount of pain and tissue tension. This is called the actual resting position.
- This is often the position where treatment is initiated.
- During treatment this position will change as pain decreases and tissues relax.

Testing Out of the Resting Position

- As your skills improve and your patients impairments decrease you will find that you need to perform joint play testing out of the resting position.
- In order to judge the degree of capsular looseness or tightness in these positions it is important to have a thorough sense of how these tissues feel normally in the resting position.
Before You Start Joint Play Testing

- **Remember…**
  1. Keep your own arms and hands relaxed. This will help you sense the movement better.
  2. Vary the speed of your testing and be sure to stabilize with an equal and opposite force.
  3. Compare your findings from side to side, and between different patients.

Avoiding Compression During Gliding

- It is important to avoid applying compression when testing joint mobility, or applying gliding forces to stretch capsular tissues.
- It has been suggested by Kaltenborn that we incorporate a grade one traction during these procedures thereby avoiding compression.
- This may or may not always be easily accomplished because of patient and therapist size, and the specific testing being performed.
- *Every effort should be used to avoid compressing the joints during these procedures!*

Glenohumeral Joint Information

- **Resting position:** 55° abduction, 30° horizontal adduction, slight external rotation
- **Closed packed position:** maximal abduction and external rotation
- **Capsular pattern:** lateral rotation-abduction-medial rotation

From Kaltenborn
Traction Joint Play

- This test is performed by stabilizing the scapula with a medial force while applying a lateral traction force on the proximal humerus.
- Note how the patient’s arm is supported by the therapist.
- Be aware of unwanted movement of the patient’s trunk. They should not lean towards you during the test.

Posterior Glide Joint Play

- This test is performed by stabilizing the scapula with an anterior force while applying a posterior gliding force on the proximal humerus.

Inferior Glide Joint Play

- During this test the scapula is stabilized by the rib cage and upper trapezius muscle.
- The test is performed by applying a caudal gliding force on the proximal humerus.
Anterior Glide Joint Play

- Here we are stabilizing the scapula with a posterior force while applying an anterior gliding force on the proximal humerus.

Compression Provocation Testing

- This technique is performed prior to contractile tissue testing to identify pain originating from an articular lesion.
- Note, this procedure may need to be held for some period of time, and can be performed with the arm in various positions.

Supine Joint Play Testing

- Joint play testing is also performed in a supine position.
- This may be used to:
  - confirm seated joint play findings
  - clarify joint play which may have been difficult to sense in the seated position
  - Reassess joint play following supine joint mobilization
Identifying the Dysfunctional Joint

• Remember:
  – When assessing a joint's mobility three different characteristics are observed: **quantity, quality, and end-feel.**
  – A dysfunctional joint has a distinctly different quantity, quality and end-feel than the joint with normal mobility.
  – A dysfunctional joint often demonstrates less quantity of movement, a change in the quality of the movement (increased resistance to a movement within the available range) and a more abrupt completion of movement with a firmer end-feel.

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Joint Mobilization

- **Indications**
  - Joint dysfunction: PROM =/> AROM but < than optimal
  - Inadequate ROM with capsular end-feel of the joint
  - Painful restriction of accessory joint motion with loss of rotational motions

Joint Mobilization

- **Benefits**
  - Increase ROM
  - Decrease of muscle guarding
  - Increased proprioceptive awareness

Joint Mobilization

**Contraindications:**
- Infection
- Neoplasm
- Recent fracture
- Acute OA, RA
- Osteoporosis
- Joint effusion
- Loss of range without capsular end-feel (i.e., muscular end-feel)
Joint Mobilization

- Direction
- Grade
- Speed

Arthrokinematic
Osteokinematic

Shoulder Joint Mobilization

- Indications
  - capsular end feel
  - pattern of restriction
  - history of:
    - pain → pain & restriction → restriction
- Mobilize or manipulate?
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Intervention for Frozen Shoulder, Adhesive Capsulitis

- Manipulation under anesthesia
- Capsular distension
- Mobilization
- Exercise

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