

Chapter 30:

Joint Mobilization

Lee Rosenzweig, PT, DPT, CHT

- I. Introduction
 - A. Definition - selective stretching of specific tissues around a joint without damaging adjacent tissue; stretching capsular structure in physiological planes.
 - B. Purpose
 - a. Remodel connective tissue to improve joint extensibility /reduce stiffness
 - b. Reduce pain and encourage relaxation
 - c. Bathe the joint with synovial fluid, externally nourishing joint structures
 - C. Review of Synovial Joints
 - a. Plane - 1° freedom (capitate on hamate)
 - b. Ellipsoid - 3° freedom (MCP)
 - c. Hinge - 2° freedom (elbow)
 - d. Sellar - 3° freedom (CMC)
 - e. Pivot - 1° freedom (proximal Radio-Ulnar joint)
 - f. Ball/Socket - 3° freedom (Glenohumeral Joint)
 - g. Bicondylar - 1-2° freedom (IPJs)
 - D. Planes of movement - coronal/sagittal/transverse
 - E. It is important to be aware of the following:
 - a. Articular Surfaces
 - i. Ovoid: convex or concave. Surface is of constantly changing angular value
 - ii. Sellar: (saddle) - inversely curved with convex/concave surfaces at right angles to each other
- II. Indications
 - A. Hypomobility - when joints are tight or stiff
 - B. When there is potential for joint limitation
 - C. Whenever passive ROM is indicated EXCEPT for replacement arthroplasty
 - D. To decrease pain: example of pain is when the surfaces pinch, or you have an uneven pulling of the soft tissue
- III. Contraindications
 - A. Joint replacement arthroplasties
 - B. Any fracture adjacent to the joints which is not clinically healed
 - C. Acute inflammatory or septic arthritis
 - D. Bone disease i.e. osteomyelitis
 - E. Bacterial infection
 - F. Malignancy/Neoplastic disease
 - G. Physiologically unstable joint
- IV. Precautions
 - A. Rheumatoid or osteoarthritis
 - B. Osteoporosis
 - C. Fracture – usually acceptable once PROM indicated

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- D. Hypermobility
 - E. Inability for patient to relax
 - F. Presence of protective muscle spasm
 - G. Joint effusion/inflammation
 - H. General debilitation (i.e. influenza, pregnancy, chronic disease)
- V. Biomechanics of Joint Mobilization
- A. Osteokinematics - Adjacent bones (flex/ext - movement you see)
 - B. Arthrokinematics (internal movement): Articular movements produced by 2 adjacent joint surfaces (accessory motions i.e. roll, spin, glide - you can not see this movement)
 - a. Spinning, rolling, gliding: without these accessory movements, impingement, compression, inflammation, and pain may occur in the joint with forced motion
 - b. Mobilization restores these accessory motions by gliding one joint surface on another thus stretching the periarticular structures in the desired direction
 - c. Concavity/convexity of joint surfaces (direction of the glide is dependent on whether concave or convex)
 - i. Concave on convex - osteokinematics same as arthrokinematics - when a concave surface is being mobilized on a convex surface, the concave joint surface is glided in the same direction that the bone is moving
 - ii. Convex on concave - osteokinematics are opposite of arthrokinematics - when a convex surface is being mobilized on a concave surface, the convex surface is glided in the opposite direction that the bone is moving
- VI. Mobilization Techniques
- A. Position of joints
 - a. Loose packed position (resting position, most relaxed, greater ROM, and most fluid movement, most play in the joint)
 - b. Position in which joint capsule and ligaments are loose
 - c. Position in which it is easier to test and treat
 - d. Examples: MCP joint - slight flexion
 - B. Closed packed position (most contact between concave and convex joint)
 - a. Position in which articular surfaces are most congruent, joint
 - b. Capsule and ligaments are tight
 - c. Position NOT used to test or treat
 - d. Example: MCP joint - 90 degrees flexion; GH joint maximal abduction and external rotation
 - C. Actual Resting Position (alternate rest position, unable to assume position, may be due to pain/injury)
 - D. Oscillations - used to stimulate mechanoreceptors and inhibit nociceptors (small arch of movement, minimal physiological movement, < 5 degrees)
 - a. Pain relief
 - b. Grades I and II
 - E. Roll/tilt (physiological movement)
 - a. New equidistant points on one surface come in contact with new equidistant points on another surface

- b. Compression on one side, separation on the other; therefore, best done with a simultaneous glide (joint damage will occur if only rolling occurs – compressive forces could pinch intra-articular structures)
- F. Glide
 - a. Same point on one surface comes in contact with new point on another surface parallel to treatment plane (happens on curved surfaces, same direction as the bone movement, glide direction is reflective of concave/convex)
- G. Spin/rotation
 - a. One point on one surface comes in contact with many points on another
 - b. Usually in combination with rolling or gliding
- H. Distraction
 - a. Displacement of bones - separation
 - b. All points move in straight line an equal distance and in same direction
- I. Grades of mobilization (Maitland's)
 - a. Grade I: Uses a small amplitude and high velocity at the beginning of the joint range
 - b. Grade II: Also uses high velocity, but slightly larger amplitude, done to mid-point of joint's total range of motion, not yet pushing into resistance
 - c. Grade III: Involves mobilizing a joint from mid-range into resistance. A lower velocity is used and a stretch is felt on the joint.
 - d. Grade IV: Has smaller amplitude than grade III, and is carried out at the end point of the joint range of motion, past the point of resistance

Grade I _____

Grade II _____

Grade III _____

Grade IV _____

- J. Patterns of restriction
 - a. Capsular pattern of restriction: characteristic pattern of decreased movement at a joint
 - i. Example: GH joint - limitations in ER, Abd, IR – the entire capsule shortens leading to a frozen shoulder.
 - b. Non-capsular pattern of restriction: typically occurs with intra-articular mechanical blockage or extra-articular lesions
 - i. Example: ligament adhesion, bursitis

VII. Mobilization Principles

- A. Evaluate by selective tension to determine which structures and forces are limited
- B. Need to determine base line mobility (what is normal for the patient) by assessing joint play on the unaffected side
- C. Determine end feel (the point where the joint motion reaches its first stop) to determine the quality of movement (see chart below)

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- a. Pathological end feel - abnormal end feel to movement i.e. muscle contraction from guarding or bony end feel but at physiological mid range from a loose body
- b. Normal end feel - physiological stop i.e. elbow flexion has soft end feel due to tissue approximation; or elbow extension has a firm end feel due to bone on bone {olecranon–distal humerus}
- D. Pain is not part of the process
- E. Body Mechanics
 - a. Patient and therapist must be relaxed
 - b. Therapist’s hand/finger force should be distributed over as large an area as possible to minimize the pressure
 - c. Distal parts should never dangle
- F. Force
 - a. Motions are controlled
 - b. Should be applied either parallel or perpendicular to the joint
- G. Only one joint is mobilized at a time
- H. Distraction may or may not be used before mobilization
- I. Positioning
 - a. One bone of the joint is stabilized near the joint line, and the other bone is mobilized – proximal fixation is key
 - b. Physiological motions may be used in positioning the joint before doing the mobilization
- J. Frequency
 - a. Short, frequent sessions (pain lasts less than 1 hour post mobilization)
 - b. Pre and post measurements
- K. Heat with stretch for increased motion and decreases muscle guarding

<u>End Feel</u>	<u>Description</u>	<u>Significance in Evaluation</u>
Bone - bone	2 hard surface meet – abrupt	Anatomical Limit of joint (elbow extension)
Spasm	Hardish feel Muscles reflexively stop movement	Acute/subacute arthritis Fracture
Capsular	Hardish feel Some give	Arthritis (frozen shoulder)
Spring back	Rebound at end of movement	Internal derangement of joint
Tissue approximation	Soft arrest movement bicep)	No mechanical block(elbow flexion
Empty	Pain some distance from anatomical limit	Suspect acute bursitis, abscess, neoplasm

VIII. Scapulothoracic Joint (Fig. 1, Fig. 2)

- A. Purpose - to increase scapular mobility on chest wall - increase subscapularis and serratus anterior gliding on each other
- B. Techniques - elevation, depression, retraction, protraction and distraction
- C. Positioning

IX. Glenohumeral Joint

- A. Distraction - to give general stretch of capsule and ligaments (Fig. 3)
- B. Inferior glide - to increase elevation and relaxation
- C. Posterior glide - to increase internal rotation (Fig. 4)
- D. Anterior glide - to increase external rotation
- E. Lateral glides - to increase horizontal adduction and general capsular stretch

X. Elbow

- A. Radiohumeral Joint
 - a. Radio-humeral anterior glides to increase flexion (Fig. 5)
 - b. Radio-humeral posterior glides to increase extension (Fig. 5)
 - c. Distraction to increase extension and supination/pronation (Fig. 6)
 - d. Elbow tilt - to decrease valgus deformity and increase extension
- B. Humeroulnar joint
 - a. Distraction - to increase flexion

XI. Forearm

- A. Proximal radioulnar joint - to increase supination and pronation (Fig. 7)
 - a. Glide of the radius on the ulna
 - 1. Proximal radius glide
- B. Distal radioulnar joint: to increase supination and pronation
 - a. Distal radius roll
 - b. Distal ulnar glide - done at end ranges of supination and pronation
 - c. Interosseous membrane stretch

XII. Wrist Joint - arthrokinematics and osteokinematics are opposite

- A. Radiocarpal joint - hold distal radius and ulna and move carpus
 - a. Distraction - general stretch of carpal ligaments (Fig. 8)
 - b. Dorsal glide - to increase flexion > extension (Fig. 9)
 - 1. Volar glide - to increase extension > flexion (Fig. 9)
 - c. Medial/lateral glide - to increase radial and ulnar deviation
- B. Midcarpal joint - same mobilizations except hold carpus and move distal row by holding on to base of metacarpals

XIII. Digits - arthrokinematics and osteokinematics

- A. Metacarpal phalangeal joint
 - a. Distraction - general capsular stretch (Fig. 10)

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- b. Dorsal glide - to increase extension (Fig. 11)
 - c. Volar glide - to increase flexion (Fig. 11)
 - 1. Medial tilt - to stretch radial collateral ligament (Fig. 12)
 - d. Lateral tilt - to stretch ulnar collateral ligament
 - e. Medial rotation - to increase supination of digit
 - f. Lateral rotation - to increase pronation of digit
 - g. Intermetacarpal glide - to increase cupping of hand
 - h. Transverse intermetacarpal ligament stretch - to increase abduction and metacarpal mobility
- B. Proximal interphalangeal joint and distal interphalangeal joint
- a. Dorsal glide - to increase extension (Fig. 13)
 - b. Volar glide - to increase flexion (Fig. 13)
 - c. Medial and lateral tilt - mostly used diagnostically

XIV. First CMC joint

- a. Dorsal glide - to increase extension
- b. Volar glide - to increase flexion
- c. Distraction - general capsular stretch
- d. Medial tilt - to increase abduction
- e. Lateral tilt - to increase adduction
- f. Rotation - to increase opposition

XV. Evidence regarding the use of joint mobilization to increase range of motion

- A. Systematic Review found six papers addressing joint mobilization and range of motion and concluded that there is a moderate level of evidence to support the use of joint mobilization in patients whose loss of motion can be attributed to joint stiffness.¹
- B. Four were prospective randomized cohort studies.
- C. **Two support** the use of joint mobilization techniques to increase range of motion compared with exercise alone in patients with adhesive capsulitis² and after metacarpal fracture.³
 - a. Shoulder adhesive capsulitis after trauma or spontaneous onset. Intervention was mobilization and active exercise program or exercise program. Both groups had increased range of motion. Level of evidence is 2b with a consensus score of 39.
 - b. Metacarpal fracture with at least 2 weeks of immobilization. Intervention was exercise or exercise with mobilization. Both groups had increased range of motion and decreased stiffness. Level of evidence is 2b with a consensus score of 38.
- D. **Two papers do not support** the use of joint mobilization after distal radius fractures⁴ and for primary impingement syndrome⁵
 - a. Uncomplicated distal radius fractures after removal of pins or pins and plaster. Intervention was advice and home exercise program with one therapy visit or passive joint or mobilization and exercise for six weeks. All outcomes in both groups improved. Flexion was greater in the mobilization group but was not clinically important change. Level of evidence is 2b with a consensus score of 43.
 - b. Primary shoulder impingement. Intervention was multiple physical therapy interventions or mobilization with multiple physical therapy interventions. Mobilization group improved on all variables. Multiple physical therapy group

- improved on mobility and function. There was no difference between groups in mobility and functional gains. Level of evidence is 2b and consensus score is 42.
- E. Two well designed case series using patients after distal radius fracture⁶ and with shoulder adhesive capsulitis⁷ support the use of joint mobilization techniques in the short term to increase joint range of motion.
- a. Stable extraarticular and intraarticular distal radius fractures, prospective cast six weeks. Intervention was oscillation radiocarpal wrist mobilizations or sustained gliding wrist stretch. Result was most gains in motion made during the application of the first technique. Both techniques resulted in improved range of motions, oscillations were more effective when patient had painful wrist and during first three sessions. Sustained wrist stretch was more effective during last three sessions. Level of evidence is 2B and consensus score is 28.
 - b. Adhesive capsulitis of the shoulder. Painful or stiff shoulder for an average of 8 months. Intervention was end-range glenohumeral mobilization techniques (distraction in angles of abduction and flexion and glides) twice a week for three months. Result was increase in glenohumeral abduction, flexion, and internal rotation. Level of evidence is 4 and consensus score is 22.
- F. Although there is moderate evidence to support the use of joint mobilization techniques in the upper extremity generally, it does not appear that the clinical merit of using joint mobilizations techniques to improve range of motion specifically in joint contractures of the hand has been clearly demonstrated.⁸

Chapter 30 Figures



Fig. 1 Describes scapular mobilization (elevation and depression) in order to increase scapular mobility.



Fig. 2. Describes scapular mobilization (elevation and depression) in order to increase scapular mobility



Fig. 3. Describes glenohumeral distraction in which the humerus is distracted from glenoid in order to increase range of motion in all planes

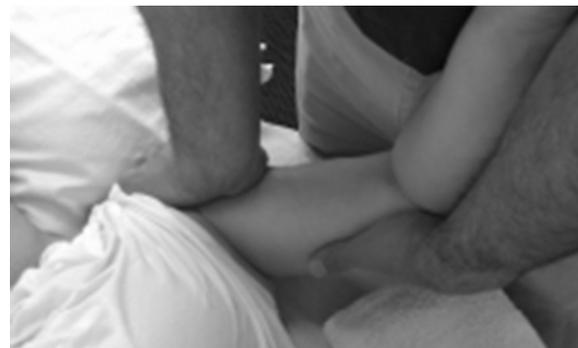


Fig. 4. Describes glenohumeral posterior glide in which the humerus is mobilized posteriorly on the glenoid in order to increase shoulder flexion and internal rotation

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Fig. 5. Describes radio-humeral glides in which the humerus is stabilized and the radius is glided anteriorly to increase elbow flexion or posteriorly in order to increase elbow extension



Fig. 6. Describes elbow distraction in which the radius and ulna are distracted from the humerus in order to increase range of motion in both flexion and extension.



Fig. 7. Describes proximal radioulnar glides and mobilization of interosseous membrane in order to increase forearm rotation.



Fig. 8. Describes long-axis wrist distraction in order to increase wrist flexion.

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Fig. 9. Describes volar and dorsal glides of the carpus. Anterior glides used to increase wrist extension. Posterior glides used to increase wrist flexion.



Fig. 10. Describes phalangeal-metacarpal long axis distraction in order to increase MP joint flexion and extension



Fig. 11. Describes metacarpal anterior-posterior glides. Anterior glides to increase flexion. Posterior glides to increase extension



Fig. 12. Describes metacarpal radial glide in order to increase MP joint extension



Fig. 13. Describes anterior-posterior glides of the middle phalanx at the proximal interphalangeal joint. Volar glide used to increase flexion. Dorsal glide used to increase extension.

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Multiple Choice Questions

1. It is usually acceptable to do grade I and II joint mobilization after a nonsurgical fracture if the patient has been cleared for:
 - A. PROM
 - B. AROM
 - C. AAROM
 - D. Scar massage
2. The abrupt meeting of two hard surfaces experienced during a selective tissue tension assessment is best described as the following:
 - A. Capsular end feel
 - B. Empty end feel
 - C. Spasm
 - D. Bone on bone end feel
3. Evidence when using joint mobilization for primary shoulder impingement shows that it:
 - A. Has varying results in clinically significant improvements in mobility and function when compared to exercise alone
 - B. Results in clinically significant improvements in mobility and function when compared with exercise alone
 - C. Requires at least a grade IV in order to significantly improve pain and strength
 - D. Improves scapulohumeral rhythm more than strengthening exercises
4. Assessment of joint mobility is performed in the following position:
 - A. In the open packed position
 - B. When joints are warm
 - C. Following active exercise
 - D. In the closed packed position
5. The following motion describes the combination of compression on one side of a joint and separation on the opposite side:
 - A. Glide
 - B. Tilt
 - C. Grade II oscillation
 - D. Grade I oscillation
6. When the same point on one surface comes in contact with a new point on another surface parallel to the treatment plane, it is referred to as:
 - A. Distraction
 - B. Oscillation
 - C. Glide
 - D. Spin/rotation

Multiple Choice Questions

7. Case Series looking at mobilizations for distal radius fractures after six weeks of casting found the following results:
 - A. Sustained wrist stretch was the most effective in improving range of motion during the first three sessions
 - B. Strength and function improved more in patients who received radiocarpal oscillations and sustained wrist stretch
 - C. Distraction resulted in shorter recovery times
 - D. Radiocarpal oscillations was the most effective type of mobilization during the first three sessions for improving range of motion

8. A patient presenting with adhesive capsulitis for 8 months is referred to your clinic for therapy. You would like to work on improving shoulder flexion and abduction for this patient. According to a well designed published case series what type of mobilization would be most effective?
 - A. End range glenohumeral mobilization with distraction in angles of abduction and flexion
 - B. Mid-range glenohumeral mobilizations with grade II oscillations
 - C. Glenohumeral rhythmic stabilization exercises and D2 PNF patterns
 - D. End range grade IV anterior glenohumeral mobilizations

9. When mobilizing the forearm to improve supination, which of the following mobilizations would be the best choice
 - A. Volar glide of the distal radius on the ulna
 - B. Dorsal glide of the distal radius on the ulna
 - C. Distraction of the radiocarpal joint
 - D. Posterior glide of the radial head on the capitellum

10. Evidence for joint mobilization in the long term following distal radius fractures:
 - A. In conjunction with an exercise program did show clinically significant improvement in range of motion measures when compared with exercise alone
 - B. In conjunction with exercise caused an increase in pain when compared with exercise alone
 - C. Resulted in significantly improved strength
 - D. In conjunction with an exercise program did not show clinically significant improvement in range of motion measures when compared with exercise alone

11. Assessment of a patient's normal joint mobility is best determined by the following:
 - A. Manual muscle testing
 - B. Using the DASH score
 - C. Assessing the opposite unaffected side
 - D. Goniometric measurements

Multiple Choice Questions

12. When one point on one joint surface comes into contact with many points on another joint surface, it is referred to as:
- A. Spin/rotation
 - B. Oscillation
 - C. Glide
 - D. Distraction
13. According to the rule of convex on concave joint movement, the following mobilization serves to increase extension of the 1st CMC joint:
- A. Medial tilt
 - B. Rotation
 - C. Dorsal glide
 - D. Lateral tilt
14. A patient presents with a non-surgical proximal phalanx fracture that does not show evidence of being clinically healed. Which of the following statements is correct?
- A. Grade II oscillations may be performed
 - B. Joint mobilizations should not be performed with this patient
 - C. Roll/tilt can be performed
 - D. Initiating strengthening would be the most effective intervention

**Multiple Choice Question Answer Key
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1-A, 2-D, 3-A, 4-D, 5-B, 6-C, 7-D,
8-A, 9-B, 10-D, 11-C, 12-A, 13-C, 14-B