ACTIVE ISOLATED
STRETCHING & STRENGTHENING
The Neck and Shoulder

Instructor: Dr. Ben E. Benjamin

AIS THEORY & PRINCIPLES

What Is It?
• Active: The client moves
• Isolated: Works the distal, proximal, and belly separately
• Stretching/Strengthening

Why does stretching come first?
In order to build strength in a full range of motion, you need to have a full range of motion first.

Components of Flexibility
There are four components of flexibility:

1. Muscle stretch: resting length of the muscle fibers
2. Joint ROM: depends on structure and any damage to the joint and surrounding ligaments
   • Each joint is constructed to allow for a particular range of motion.
   • What counts as full range of motion (optimal flexibility) depends on the joint, the direction you’re trying to move, and the person’s musculoskeletal structure.
   • Examples: Neck flexion 90°, side flexion 60°; Hip medial rotation 90°, extension of hip joint 30°
3. Tissue damage: any damage to the joint, muscle, or connective tissue
4. Ligament laxity/length (Example: hyperextended knees)

AIS addresses the first three: stretches the muscles, increases range of motions of joints, and it also strengthens tendons and ligaments but does not change the laxity.

The Role of Fascia
Fascia is a complex, interconnected fibrous matrix that runs throughout the entire body — surrounding not only our muscles, bones, and joints, but also the sensory organs of the nervous system, blood vessels, and lymph channels. The functions of fascia include:
• promoting structural integrity and strength
• hydrating and oxygenating the tissues of the body
• promoting lymphatic flow
• facilitating the removal of toxins
• helping to balance the body’s neuromuscular and electromagnetic fields
Over time, AIS work can remodel fascia that has become distorted due to injury, aging, physiological imbalances, or other factors. AIS helps to break down scar tissue in fascial sheaths and reduces the risk of future fascial strains.

**Dangers of Stretching Improperly**
When performed improperly, stretching can exacerbate the very condition it was originally intended to ameliorate, leading to:
- muscle tears and strains
- ligament and tendon injuries
- damage to joints
- decreased flexibility
- chronic soreness and lactic acid buildup in muscles

**Common Mistakes in Stretching**

**Done too fast or held too long**
- Embedded in our tissues are safeguards.
- To prevent tearing, there are Golgi tendons and spindle fiber organs.
- Spindle fiber organs determine the resting tensional length of the muscle, acting as a “thermostat” for tension within the muscle.
- Stretch that’s too fast or too long leads to muscle contraction.

**No warm-up**
- Collagen fibers are the filaments in connective tissue.
- Extremely strong when hydrated, a collagen fiber can be stretched up to 1.7 times its resting length.
- However, it will rupture if stretched to this same length if not warmed up.

**Benefits of Stretching Properly**
- enhanced health of the muscles, tendons, ligaments, fascia, and joints
- restored mobility (increasing flexibility and strength, along with reduced muscular tension, can reverse the primary characteristic of aging: joint and muscle immobility)
- reduced risk of muscle spasms, strains, and tears
- decreased vulnerability to injury (strong flexible muscle resists stress better than strong inflexible muscle)
- improved circulation of blood and nutrients, which promotes tissue growth and repair
- improved circulation and drainage of lymph, which helps eliminate waste
- breakdown of adhesions caused by trauma or inflammation
- increased immune system response
  - Stretching affects the collagen fiber which is the basis of the immune system.
- Mast cells secrete histamine, which opens the capillaries so more of the liquid part of blood can move into the tissue.
- This allows the white blood cells to fight infection.
- Lack of flexibility decreases the immune system's ability to respond.

**Principles of Efficient Stretching and Strengthening**

Main Premise of AIS: Cyclical, active stretching is more physiologically sound than prolonged passive (static) stretching.
- **Active:** contracting the opposite muscle to the muscle being stretched.
- **Cyclical:** holding a stretch for a short time, then repeating it multiple times.

**Principle #1: Prolonged or forceful stretching is counterproductive.**
After about 2 seconds, a muscle contracts defensively in response to a stretch that is forceful enough to injure it. (This action is known as the myotatic or stretch reflex.) AIS avoids this problem by stretching gently for no more than 2 seconds.

**Principle #2: Active movement facilitates stretching.**
Sherrington's Law of reciprocal inhibition in muscular contraction states that when a muscle on one side of a joint is contracted, the muscle on the opposite side of the joint is sent a neurological signal to relax or release. AIS incorporates this principle by having the person actively initiate all movements.

**Principle #3: Muscles are more efficiently stretched when they are at rest or relaxed**
Momentary rest between stretches is as important as the stretch itself. It reduces fatigue and enhances blood flow to resupply oxygen and nutrition and eliminate waste products. In AIS, there is a momentary pause after each stretch.

**Principle #4: Regular breathing increases oxygenation**
Increased oxygenation of the blood helps deliver nutrition to the muscles and improves waste removal. When oxygen is lacking anaerobic metabolism occurs, converting glucose to lactic acid, which promotes fatigue. In AIS, we coordinate each stretch with an exhalation.

**Principle #5: Flexibility is specific**
Flexibility is most efficiently maximized by identifying and then isolating which part of which muscle is inflexible. AIS stretches are designed to stretch the distal and proximal ends of a muscle separately. In addition, they use 45° rotations in both directions to maximize the stretching of all the different muscle fibers.

**Principle #6: Specific movement establishes specific neuromuscular pathways**
Repetition of specific movements creates new neuromuscular patterns, essentially rewiring the neuromuscular system. In this way, AIS stimulates neurogenesis — the development of new neurons — and improves the functioning of existing neurons.
**Principle #7: A gentle assist facilitates increased flexibility**

Another factor that stimulates neurogenesis is actively going beyond a person’s normal capacity. Gentle assists challenge the tissue, facilitating neurological development and enabling a gradual increase in flexibility. People who have degenerative neuromuscular conditions such as multiple sclerosis or polio are generally not encouraged to move beyond their comfort level — which means there’s no opportunity for them to restore lost functioning. AIS uses a gentle assist with every stretch to challenge the muscle slightly beyond the person’s level of comfort.

**Principle #8: A muscle’s ability to withstand a stretch and tensile force is important for injury prevention.**

To injure a normal muscle, the muscle must either be stretched beyond its capacity or subjected to a load that is too great for it to bear. A strong muscle can absorb greater amounts of force and a fully flexible muscle can lengthen and absorb force before failure or injury occurs. In AIS, we build both strength and flexibility so that there are no longer any weak links.

**Principle #9: Flexibility and strength are interdependent.**

Flexibility without strength and strength without flexibility are both inefficient and increase the vulnerability to injury and dysfunction. Typically people are weakest at the end of their range of motion. AIS develops strength within the optimal range of motion.

**Principle #10: Muscle extensibility increases with body temperature. (from DeLee research 2003)**

The basic, ground substance of connective tissue is hyaluronic acid — a highly viscous substance that binds and lubricates the collagen, elastin, and muscle fibers. It has the consistency of Vaseline at room temperature when the muscles are “cold,” and as the temperature of the muscle increases it becomes more malleable and fluid. This is why warming up is important in order to maximize flexibility before any strenuous activity. By combining active movement with stretching in AIS, the muscles quickly become very warm.

**Principle #11: To prevent injury, minimal force should be used during stretching.**

Laboratory studies show that most muscle injuries occur when more than 70% of maximal sustainable force is used. The same research showed that 50% or less of maximal force should be used to prevent injury. AIS always uses 50% or less of maximal force.

**Principle #12: Placing tension throughout ligaments and tendons increases their strength**

The way to strengthen tendons and ligaments is to put tension through them. Brief, repeated stretches put a tensile force through these structures and increase their strength. (In contrast, prolonged stretching can lead to injury; tendons and ligaments are not elastic, and therefore when you stretch them, you damage their integrity and structure.) AIS uses only brief, repeated stretches, strengthening these structures without straining them.

*Active Isolated Stretching/Strengthening is based on these 12 physiological principles.*
Summary of Physiological Principles of AIS

- Active initiation of movement by the agonist produces a relaxation of the antagonist.
- Slow gentle repetitions promote new neuromuscular pathways.
- Repeated gentle stretching pumps blood in and out of muscle tissue, maximizing relaxation.
- At the end of the person’s active motion, a gentle assist is provided to potentiate the muscle’s range of motion.
- Each stretch is held for no more than two seconds only, releasing before the stretch reflex contracts the stretching muscle.

Things to Pay Attention To

- Active: the client initiates each movement
- Assist at the end, not the beginning of the motion
- Touch gently without gripping
- Work slowly — don’t rush
- Find the way to move your body efficiently without strain
- Check in with the client frequently about any discomfort and respond appropriately
- Pay attention to the physical personal boundaries while you work
- Be sure the client breathes out during each stretch and in during recovery
- Breathe with the client to remind them occasionally
- Count two seconds at a medium speed: 1, 2, 3 — not too fast or too slow
- Identify the stretch barrier or end feel at the person’s limit
- Gently go 2° or 3° beyond the person’s end feel each time
- Strive to identify end feel appropriate for the person you are working with
- Find pressure that is in resonance with that person: not too much or too little
- Work the angles at 45°
- Perform 8 to 10 repetitions of each stretch

Effects of AIS on Different Musculoskeletal Structures

- **Muscles:** Stretch
- **Tendons:** Put tension through them to strengthen them
- **Ligaments:** Put tension through them to strengthen them
- **Joints:** Mobilize joints through their full range of motion. These carefully graded motions reduce scar tissue.
ACTIVE ISOLATED STRETCHING & STRENGTHENING
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Shoulder Stretching Protocol
1. Horizontal
2. Hyper extension
3. Horizontal clap in back
4. Triceps
5. Rotations
6. Adduction
7. Elevation

Warm up circles

1. Horizontal Abduction: pectoralis major and minor, subscapularis, anterior joint capsule

Horizontal abduction at 90°

Horizontal abduction at 135°
(alternate position over elbow)
2. **Hyper-extension Single Arms**: biceps, pectoralis major and minor, anterior deltoid, supraspinatus

- **Straight back thumb up**
- **Straight back palm up**
- **Straight back palm down**
- **Straight back rotate thumb down**
3. Hyper-extension both arms: biceps, pectoralis major and minor, anterior deltoid, supraspinatus

Hands clasped and turned out 90° — page 89

Both hands parallel back and up

Horizontal abduction — posterior (clap in back) 195° — page 90

4. Triceps Stretch: triceps, serratus anterior and the anterior joint capsule

With arm parallel

With elbow to the side — page 95
5. **Rotation**

*External Rotation: subscapularis, pectoralis major, latissimus dorsi, and teres major*

With the upper arm at 95° sitting

With the upper arm at 95° standing — page 91

With the elbow into the side sitting (frozen shoulder) — page 90

Lying on a table facedown (using elbow and forearm) — page 91

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*Internal Rotation: infraspinatus, supraspinatus, and teres minor*

With the upper arm at 95° sitting

With the upper arm at 95° standing — page 92

Lying on a table facedown (using elbow and forearm) — page 93
6. Horizontal Flexion (adduction): infraspinatus, teres minor, trapezius, rhomboid major and minor

Thumb up — page 94

Palm up

Palm down

Thumb down

45° down

Horizontal flexion 2 (elbow to throat) — page 94

7. Forward Elevation: triceps, posterior deltoid and anterior serratus

Straight arm — page 95

Sideward elevation thumb up — page 97

Thumb down — page 97

With the rope — page 95
Neck Stretching Protocol

Neck Sitting

Anterior semicircles (warm-up) — page 109

Cervical flexion — page 109

Cervical flexion at 45° rotation

Cervical anterior oblique (flexion): Rotate neck 45°, left ear to left chest 45° — page 112

Cervical lateral flexion 45–60° — page 110

Cervical hyper-extension (elbows on knees) 50°

Cervical posterior oblique extension (elbows on knees), ear to same side medial border 45°

Cervical rotation 90° — page 110
Shoulder Strength Protocol

Shoulder Girdle
- Elevation: supine (resisted shoulder shrug) — page 37, #1
- Depression: start in shoulder shrug, resist down (resisted elbow depression) — page 37, #2
- Shoulder abduction/protraction: supine (round forward against resistance) — page 38, #3
- Shoulder adduction/retraction: prone (chin on table, arms side off table, retract shoulder blades) — page 38, #4

Shoulder Upper Arm (start with 1 or 2 pounds — 3 to 5 sets of 10)
- Forward flexion (sitting or standing raise arms to 90° and 180°) — page 39, #1
- Shoulder forward elevation (same to 180° on the table, head and arms off the table) — page 39, #2
- Abduction (sitting or standing 90°, then rotate hands up to 180°) — page 40, #3
- Hyperextension (sitting arms extend backward) — head is in slight flexion — page 40, #4
- Horizontal adduction: supine (on the table) — page 41, #5
- Pectoral press (hands in front of the shoulders, straighten the arms)
- Triceps (arms above at 90°, bend the elbows)
- Horizontal abduction: prone (on the table/arms off table, arms up to the side, head up) — page 41, #6
- Single arm horizontal extension (arm off the table to the side, head off also, bend elbow) — page 42, #7
- Shoulder girdle adduction: prone (elbows up and back) — page 42, #8
- External shoulder rotation: side-lying — page 42, #9
- External shoulder rotation: prone (two arm elbows bent rotation) — page 43, #10
- Internal shoulder rotation: side-lying (bottom arm medial rotation) — page 43, #11
- Internal shoulder rotation: prone (both arms at once) — page 44, #12
- Shoulder forward elevation: prone (at 45°, thumbs up) — page 44, #13
- Shoulder horizontal extension with internal rotation: prone (arms side/internal rotation) — page 45, #14
- Supraspinatus exercise (sitting or standing — internally rotate, bring forward at 45°) — page 45, #15
- Winged scapulae stabilization (standing leaning against wall, shoulder blades together) — page 45, #16
- Scapula stabilization: supine (arms crossed in front — extended raise and lower shoulders) — page 46, #17
- Shoulder shrug no weights (sitting or standing — shoulders forward, up, back, relax) — page 47: 1, 2, 3, 4
Neck Strength Protocol

Neck Gravity (lying on table)
- Cervical flexion: supine — page 30, #5
- Cervical flexion: supine, at 45° — page 31, #6
- Cervical flexion: oblique (right ear to right chest) — page 31, #7

- Cervical lateral flexion: side-lying — page 31, #8
- Cervical rotation: side-lying — page 30, #4
- Cervical hyperextension: prone — page 29, #1
- Cervical hyperextension: oblique — page 29, #2
- Cervical rotation: prone (no photo)
Seated Trunk Stretches

Sitting Trunk Flexion
erector spinae and
sacrospinalis

Lateral Trunk Flexion
lateral spine flexors, quadratus lumborum
(lateral), obliques, and erector spinae

Seated Trunk Rotation — page 141
thoracic and lumbar
rotators

Lateral Trunk Flexion Forward Oblique
(hand behind head, rotate, left shoulder to left
knee)
serratus posterior, latissimus dorsi, and
posterio quadratus lumborum

Thoracic Lumbar Rotation with Forward Bend
— page 142
(hands behind head, rotate, left shoulder to right
knee)
rotatores, erector spinae, and sacrospinalis

Thoracic Extension Posterior Oblique
(leaning onto table 45°rotation and
bend backward)
rectus abdominus, internal obliques,
external obliques, intercostals, and
anterior serratus
The Shoulder

Circumduction (warm-up)
Horizontal Abduction 1 (90°, 135°, 45°)
   (alternate position over elbow at 135°)
Double Horizontal Abduction 1 (90°)
Horizontal Abduction 2 (hands folded behind the neck)

Hyper-extension Single Arms, 90°
   - Straight back, thumb up
   - Palm down
   - Palm up
   - Thumb down
   - Out to 45°, thumb up
   - Out to 45°, palm up
   - Out to 45°, palm down
   - Out to 45°, thumb down
   - Reach behind, thumb up, crossed 45°
   - Reach behind, palm up, crossed 45°
   - Reach behind, palm down, crossed 45°
   - Reach behind, thumb down, crossed 45°

Hyper-extension Hands Clasped (turned out) 90°
Both hands parallel and back and up
Horizontal Abduction – posterior (clap in back)
Triceps Stretch 15°
- With arm parallel
- With elbow to the side

External Rotation 80°
- Down on knee: With the upper arm at 90° sitting
- Down on knee: With the upper arm at 90° standing

Internal Rotation 90°
- Down on knee: With the upper arm at 90° sitting
- Down on knee: With the upper arm at 90° standing

Horizontal Adduction 90°
- With thumb up
- With palm up
- With palm down
- Full rotation thumb down
- Elbow to throat

Forward Elevation
- Thumb up with arm straight

Sideward Elevation 15°
- Palm forward and thumb down
The Neck (sitting)

Anterior Semicircles (warm-up)

Cervical Flexion – Chin to chest

Cervical Flexion at 45° rotation - Chin to mid-breast

Cervical Anterior Oblique (Flexion)
  Rotate neck 45°, left ear to left chest

Cervical Lateral Flexion – Ear to shoulder

Cervical Extension (elbows on knees), look up

Cervical Posterior Oblique Extension (elbows on knees), ear to same side shoulder blade, 45°

Cervical Rotation 90° - Rotate the head
Neck Gravity (lying on table)

Cervical Flexion: Supine

Cervical Flexion: at 45° Supine

Cervical Flexion: Oblique (right ear to right chest)

Cervical Lateral Flexion (side-lying)

Cervical Rotation (side-lying)

Cervical Hyperextension (prone)

Cervical Hyperextension Oblique

Cervical Rotation (prone)
Shoulder Stretching Protocol

G = Range of motion goal; LA = Lift angle

Warm up circles

8. Horizontal Abduction: pectoralis major and minor, subscapularis, anterior joint capsule
   Horizontal abduction at 90°, G:90° (180° front to back)

Horizontal abduction at 135°, G:45°

Horizontal abduction 1 at 45°, G: 90°
Double horizontal abduction 1 at 90°, G: 90° (180° front to back)

Single arm horizontal abduction 2 (one hand folded behind the neck), G: 45°: pectoralis minor

Horizontal abduction 2 (hands folded behind the neck), G: 45°: pectoralis minor

Straight back thumb up

Straight back palm up

Straight back palm down

Straight back rotate thumb down
Back with thumb up, out to 45°

Back with palm up, out to 45°

Back with palm down, out to 45°
Back with thumb down, out to 45°

Reach behind thumb up, crossed 45°

Reach behind palm up, crossed 45°, G:90° with the hand behind the opposite shoulder
Reach behind palm down, crossed 45°

Reach behind thumb down, crossed 45°

10. Hyper-extension both arms: biceps, pectoralis major and minor, anterior deltoid, supraspinatus

Hands clasped and turned out 90°, G:90° — page 89
Both hands parallel back and up (transition movement only)

Horizontal abduction — posterior (clap in back), G:195° (hands touch at shoulder height) — page 90

11. Triceps Stretch: triceps, serratus anterior and the anterior joint capsule, G:15°
With arm parallel  With elbow to the side — page 95
12. Rotation

*External Rotation: subscapularis, pectoralis major, latissimus dorsi, and teres major*

With the upper arm forward 5° and the elbow bent at 95°, G:90°

With the upper arm at 95° standing — page 91

With the elbow into the side sitting (frozen shoulder), G:90° — page 90

Lying on a table facedown (using elbow and forearm), G:90° — page 91
Internal Rotation: infraspinatus, supraspinatus, and teres minor

With the upper arm forward 5° and the elbow bent at 95° sitting, G:90°

With the upper arm at 95° standing — page 92

Lying on a table facedown (using elbow and forearm) — page 93
13. Horizontal Flexion (adduction): infraspinatus, teres minor, trapezius, rhomboid major & minor, G:90°

Thumb up — page 94

Palm up

Palm down

Thumb down

45° down
Horizontal flexion 2 (elbow to throat) — page 94

14. Forward Elevation: triceps, posterior deltoid and anterior serratus

Straight arm, G:15° beyond vertical — page 95

Sideward elevation thumb up, G:15° beyond vertical — page 97

Thumb down — page 97

With the rope, G:fist to the lower scapula — page 95
Neck Stretching Protocol

Anterior semicircles (warm-up), page 109

Cervical flexion, G: chin to chest, page 109

Cervical flexion at 45° rotation, G: chin to chest

Cervical anterior oblique (flexion): Rotate neck 45°, left ear to left chest G:45° — page 112
Cervical lateral flexion, G:45-60° — page 110

Cervical hyperextension (elbows on knees), G:50–60°

Cervical posterior oblique extension (elbows on knees), ear to same side medial border, G:45°
Cervical rotation, G:90° — page 110
ACTIVE ISOLATED
STRETCHING & STRENGTHENING
The Elbow, Wrist & Hand

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Elbow, Wrist, and Hand Stretching Protocol

• Radial ulnar pronation 90° (biceps, supinator muscles)
• Radial ulnar supination 90° (biceps, brachioradialis, supinator muscles)
• Wrist extension: hand supine 90°, and at 45° each way (flexor carpi radialis, flexor carpi ulnaris, flexor digitorum; greater emphasis at proximal attachments)

• Wrist extension: hand prone 90°, and at 45° each way (flexor carpi radialis, flexor carpi ulnaris, flexor digitorum; greater emphasis at distal attachments)
• Wrist extension: hand prone 90° with the fingers, and at 45° each way (flexor carpi radialis, flexor carpi ulnaris, flexor digitorum; greater emphasis at distal attachments)
• Wrist flexion: hand prone 90°, and at 45° each way (extensor carpi radialis longus, extensor carpi radialis brevis, extensor carpi ulnaris)
• Wrist flexion: hand supine 90°, and at 45° each way (extensor carpi radialis longus, extensor carpi radialis brevis, extensor carpi ulnaris)

• Wrist flexion — finger extensors stretch, with a fist (extensor carpi radialis longus, extensor carpi radialis brevis, extensor carpi ulnaris, extensor digitorum, extensor indicis, extensor digiti minimi)
• Wrist ulnar flexion, fingers extended (flexor carpi radialis, extensor carpi radialis longus)
• Wrist ulnar flexion, and with grasping the thumb (flexor carpi radialis, extensor carpi radialis longus)
• Wrist radial flexion, fingers extended or in a fist (extensor carpi ulnaris, flexor carpi ulnaris)

• Finger flexor stretch: hand prone 90° — extend (lumbricals, flexor digitorum superficialis, flexor digitorum profundus, flexor digiti minimi)
• Finger extensors stretch — flexion (extensor digitorum, extensor indicis, extensor digiti minimi)
• Finger adductor (web) stretch (webs and interossei palmaris between each finger)
• Finger joint extension — each joint stretch (flexor muscles of the fingers and the joint)
• Finger joint flexion — each joint stretch (joints)

• Thumb adductor (web) stretch, and up (abductor pollicis longus, abductor pollicis brevis)
• Thumb opposition stretch, down at 90° to index finger (opponens pollicis, flexor pollicis brevis, adductor pollicis)
• Thumb abductor stretch (*abductor pollicis longus, abductor pollicis brevis*)
• Thumb extensor stretch — joints 1, 2 and 3 with thumb in the fist, as in ulnar flexion (*extensor pollicis longus, extensor pollicis brevis*)
• Thumb flexor stretch (*extensor pollicis brevis and longus and the joints*)
Elbow, Wrist, and Hand Strength Protocol

Elbow
- Elbow flexion: seated, arm flat across the table (brachialis)
- Elbow flexion: standing arm curls (biceps, brachialis, and brachioradialis)
- Elbow flexion: hand prone (brachioradialis; also biceps and brachialis)
- Elbow extension: supine (triceps, anconeus)
- Elbow extension: prone — elbow at edge of table, thumb down (triceps, anconeus)
- Shoulder hyperextension: seated, head forward, arms reach back (triceps, deltoid)

Radial – Ulnar
- Supination: assisted — elbow at 90°, in the handshake position (biceps, supinator muscles)
- Pronation: assisted — elbow at 90°, in the handshake position (pronator quadratus, pronator teres)
- Pronation: active — side-lying with a weight (pronator quadratus, pronator teres)
- Supination: active — side-lying with a weight (biceps, supinator muscles)

Wrist
- Wrist hyperextension: assisted — begin in flexion (extensor carpi radialis longus, extensor carpi radialis brevis, extensor carpi ulnaris)
- Radial flexion: abduction — handshake position, thumb side goes up (extensor carpi radialis longus, flexor carpi radialis)
- Wrist flexion: assisted — begin in extension, hand up (flexor carpi radialis, palmaris longus, flexor carpi ulnaris)
- Ulnar flexion: adduction — done in the horizontal plane (extensor carpi ulnaris, flexor carpi ulnaris)

- Radial flexion: active with weight — sitting position, move toward thumb (flexor carpi radialis, extensor carpi radialis longus, extensor carpi radialis brevis)
- Ulnar flexion: active with weight — sitting position, move toward ulna (flexor carpi ulnaris, extensor carpi ulnaris)
- Wrist flexion: active with weight — seated with wrist on knee (flexor carpi radialis, palmaris longus, flexor carpi ulnaris)
- Wrist hyperextension: active with weight — seated with wrist on knee (extensor carpi radialis longus, extensor carpi radialis brevis, extensor carpi ulnaris)

Wrist Roller Device
- Wrist roller hyperextension, sitting or standing (extensor carpi radialis longus, extensor carpi radialis brevis, extensor carpi ulnaris)
- Wrist roller flexion, sitting or standing (flexor carpi radialis, palmaris longus, flexor carpi ulnaris)
Thumb

- Thumb abduction: rubber band, out at 45° (*abductor pollicis longus, abductor pollicis brevis*)
- Thumb extension, proximal: single rubber band, thumb extended throughout (*extensor pollicis brevis, extensor pollicis longus, abductor pollicis longus*)
- Thumb extension distal: double rubber band, support proximal thumb (*extensor pollicis longus, extensor pollicis brevis, abductor pollicis longus*)
- Thumb circumduction: double rubber band, fist, palm down, thumb goes up (*tissues extending from the base of the thumb over to the base of the index finger*)
- Thumb adduction: hold double rubber band with other hand and adduct (*adductor pollicis*)
- Thumb adduction with ball: squeeze (*adductor pollicis*)
- Thumb hyperadduction: thumb roll through (*adductor pollicis, extensor pollicis brevis*)
- Thumb opposition: thumb and fifth digit (*opponens pollicis, flexor pollicis brevis, abductor pollicis brevis, flexor digiti minimi, small intrinsic muscles of the hand*)
- Thenar eminence: squeeze without the thumb (*opponens pollicis, flexor pollicis brevis, abductor pollicis brevis*)

Finger–Thumb Exercises

- Finger–thumb distal flexors with ball: fingertips grip the ball (*flexor digitorum profundus, flexor digitorum superficialis, lumbricals, flexor pollicis longus*; also: *flexor pollicis brevis, adductor pollicis, opponens pollicis*)
- Finger thumb distal flexors with ball: single, one fingerbreadth thumb at a time (*flexor digitorum profundus, flexor digitorum superficialis, lumbricals, flexor pollicis longus, flexor pollicis brevis, adductor pollicis, opponens pollicis*)
- Finger flexors with ball: all fingers together, no thumb (*flexor digitorum superficialis, flexor digitorum profundus, lumbricals, flexor carpi radialis, palmaris longus, intrinsic muscles of the hand*)
- Finger flexors with ball: single — one at a time, holding the others still with other hand (*flexor digitorum muscles*)
- Finger flexors with rubber band: each joint separately, double rubber band (*flexor digitorum profundus*)
- Finger adduction with ball: between each of the fingers (*palmar interossei*)
- Finger abduction: double rubber bands (*dorsal interossei, digiti minimi*)
- Finger–thumb extension: with rubber band, spread all the fingers and thumb (*extensor digitorum communis, extensor indices (second finger), extensor digiti minimi (little finger), extensor pollicis longus, extensor pollicis brevis, abductor pollicis longus, abductor pollicis brevis*)
- Finger extension with rubber band: each joint at a time, begin proximally
  Metacarpophalangeal joint: *extensor digitorum*
  Middle phalangeal joint: *finger extensors*
  Distal phalangeal joint: *extensor digitorum longus*
Elbow, Wrist, and Hand Stretching Protocol

- Radial ulnar pronation 90°
- Radial ulnar supination 90°
- Wrist extension: hand supine 90°, and at 45° each way
- Wrist extension: hand prone 90°, and at 45° each way
- Wrist extension: hand prone 90° with the fingers, and at 45° each way
- Wrist flexion: hand prone 90°, and at 45° each way
- Wrist flexion: hand supine 90°, and at 45° each way
- Wrist flexion — finger extensors stretch, with a fist
- Wrist ulnar flexion, fingers extended
- Wrist ulnar flexion, and with grasping the thumb
- Wrist radial flexion, fingers extended or in a fist
- Finger flexor stretch: hand prone 90° — extend
- Finger extensors stretch — flexion
- Finger adductor (web) stretch
- Finger joint extension — each joint stretch
- Finger joint flexion — each joint stretch
- Thumb adductor (web) stretch, and up
- Thumb opposition stretch, down at 90° to index finger
- Thumb abductor stretch
• Thumb extensor stretch — joints 1, 2 and 3 with thumb in the fist, as in ulnar flexion
• Thumb flexor stretch

Elbow, Wrist, and Hand Strength Protocol

Elbow
• Elbow flexion: seated, arm flat across the table
• Elbow flexion: standing arm curls
• Elbow flexion: hand prone
• Elbow extension: supine
• Elbow extension: prone — elbow at edge of table, thumb down
• Shoulder hyperextension: seated, head forward, arms reach back

Radial – Ulnar
• Supination: assisted — elbow at 90°, in the handshake position
• Pronation: assisted — elbow at 90°, in the handshake position
• Pronation: active — side-lying with a weight
• Supination: active — side-lying with a weight

Wrist
• Wrist hyperextension: assisted — begin in flexion
• Radial flexion: abduction — handshake position, thumb side goes up
- Wrist flexion: assisted — begin in extension, hand up
- Ulnar flexion: adduction — done in the horizontal plane

- Radial flexion: active with weight — sitting position, move toward thumb
- Ulnar flexion: active with weight — sitting position, move toward ulna
- Wrist flexion: active with weight — seated with wrist on knee
- Wrist hyperextension: active with weight — seated with wrist on knee

Wrist Roller Device
- Wrist roller hyperextension, sitting or standing
- Wrist roller flexion, sitting or standing

Thumb
- Thumb abduction: rubber band, out at 45°
- Thumb extension, proximal: single rubber band, thumb extended throughout
- Thumb extension distal: double rubber band, support proximal thumb
- Thumb circumduction: double rubber band, fist, palm down, thumb goes up
- Thumb adduction: hold double rubber band with other hand and adduct


- Thumb adduction with ball: squeeze
- Thumb hyperadduction: thumb roll through
- Thumb opposition: thumb and fifth digit
- Thenar eminence: squeeze without the thumb

Finger–Thumb Exercises

- Finger–thumb distal flexors with ball: fingertips grip the ball
- Finger thumb distal flexors with ball: single, one fingerbreadth thumb at a time
- Finger flexors with ball: all fingers together, no thumb
- Finger flexors with ball: single — one at a time, holding the others still with other hand

- Finger flexors with rubber band: each joint separately, double rubber band
- Finger adduction with ball: between each of the fingers
- Finger abduction: double rubber bands
- Finger–thumb extension: with rubber band, spread all the fingers and thumb
- Finger extension with rubber band: each joint at a time, begin proximally

Metacarpophalangeal joint: extensor digitorum
Middle phalangeal joint: finger extensors
Distal phalangeal joint: extensor digitorum longus
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