Study Guide 5

This guide covers the two treatment chapters. The technique items are really safety items: should this patient be adjusted, and if so how must the procedure change? The supportive care items test the same habit with modalities, supplements, exercise and counseling. Learn each choice with the contraindication that rules it out. Work one chapter at a time, study the diagram, copy the tables, cover the steps of each worked case (every number has been checked), then do the self-tests and the cram sheet.

WHAT THIS GUIDE COVERS

- Chapter 9 · proceed, modify or refer; absolute and relative contraindications; osteoporosis, anticoagulation, RA, AS, Down syndrome, pregnancy and children; technique systems; Maitland grades and barriers; extremity glides and the convex concave rule; facet planes, coupling and Fryette; Gonstead and pelvic listings; dissection screening; adverse events; consent and documentation.
- Chapter 10 · cryotherapy, heat, ultrasound, electrical stimulation, traction and laser; nutrition patterns, supplements, interactions, bone health and weight; healing phases, stabilization, McKenzie and dosing; lifting, workstation, sleep and return to work; exercise prescription, tobacco, alcohol, sleep, stress and stages of change.

CHAPTER 9

Chiropractic Technique Decisions

Read it in full: **Chapter 9 in the textbook**. Practice it: **the Study Guide 5 practice exam** and **the flashcards**.

What to know

Technique items ask whether this patient should be adjusted at all, which procedure fits, how it must change for a fragile, anticoagulated, pregnant or young patient, and what to do when something goes wrong. Manipulation is indicated for **mechanical joint dysfunction**: pain and restricted motion that change with position and load and localize to a segment. Constant, nonmechanical night pain is a workup question, not a technique question. The day's decision has

three outcomes: **proceed**, **modify** for a relative contraindication, or **do not manipulate and refer** for an absolute contraindication or red flag. A contraindication is judged at the target region: a T8 metastasis forbids thrust at T8, not gentle ankle care.

Absolute contraindications at the region: acute fracture, tumor, osteomyelitis or discitis, severe osteoporosis with fragility fracture there, dislocation, ligamentous instability (RA, Down syndrome, os odontoideum), cauda equina, myelopathy, rapidly progressive deficit, suspected dissection, symptomatic AAA (lumbar thrust), acute inflammatory flare, ankylosed segments, uncontrolled bleeding and refusal of consent. Relative ones (osteopenia, stable spondylolisthesis, hypermobility, stable radiculopathy, stable anticoagulation, pregnancy) are answered by changing force, position and technique. A relative contraindication almost always means modify, not "do not treat."

Osteoporosis (T score −2.5 or lower, or a fragility fracture): vertebrae fail in flexion and compression, ribs under prone PA load. Avoid prone body weight thrusts, rib springing, forced rotation and flexion exercise; use instruments, a light drop, mobilization and extension biased exercise. A new thoracic pain after trivial load is a fracture until films say otherwise. **Anticoagulation**: ask about INR (usually 2 to 3), bruising and bleeding; supratherapeutic INR or spontaneous bruising means no thrust and a call to the prescriber; sudden severe back pain then progressive weakness may be an epidural hematoma. In **RA** check the ADI (over 3 mm in adults, 5 mm in children) before upper cervical work; never thrust a fused **AS** segment.

Pregnancy: use pregnancy cushions or an abdominal drop, side posture with little rotation and less force; after about 20 weeks avoid prolonged supine (supine hypotensive syndrome: turn her onto her left side). Bleeding, fluid leak, preterm contractions, decreased fetal movement and preeclampsia (140/90 or more after 20 weeks with headache or visual change) mean obstetric referral. **Children**: fingertip pressure for infants, low force for young children, full thrust only in older adolescents, and remember leukemia, septic joint, SCFE, Perthes and nonaccidental trauma.

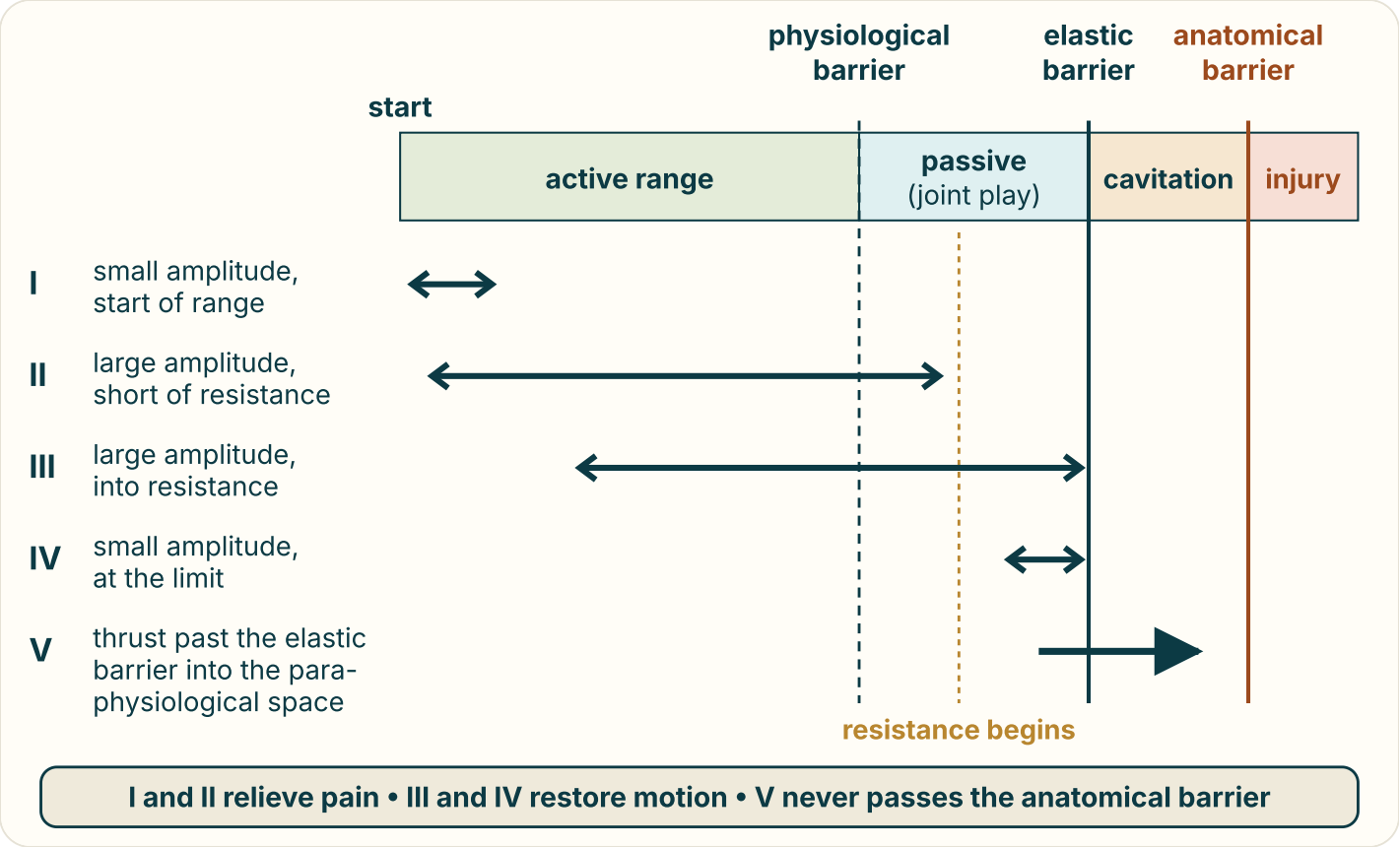
Match the system to the case: **diversified** HVLA for most restrictions; **Gonstead** for specific listings with little rotation; **Thompson drop** for the pelvis and large patients; **flexion distraction (Cox)** for disc herniation, stenosis, spondylolisthesis and older patients; **instrument** for osteoporosis, children, anxious or anticoagulated patients; **SOT blocking** for the pelvis and

pregnancy; mobilization when pain blocks end range. Maitland grades: I small at the start, II large short of resistance, III large into resistance, IV small at the limit, V a thrust past the elastic barrier into the paraphysiological space, never past the anatomical barrier.

Extremities: work from the loose packed position after fracture, dislocation and serious disease are excluded. **Convex on concave glides opposite** (shoulder, hip, talocrural, radiocarpal); **concave on convex glides the same way** (tibia on femur, phalanx on metatarsal). So inferior glide restores shoulder abduction, posterior glide restores shoulder flexion and IR, posterior talar glide restores dorsiflexion, anterior tibial glide restores knee extension, dorsal carpal glide restores wrist flexion. Capsular patterns: shoulder ER, then abduction, then IR; hip IR, flexion, abduction; knee and elbow flexion more than extension. Pulled elbow (age 1 to 4) is reduced by hyperpronation; cuboid syndrome by the cuboid whip. Never adjust a scaphoid fracture, lunate dislocation or supracondylar fracture.

Facets: C3 to C7 at about 45 degrees to the transverse plane (lateral flexion and rotation coupled to the same side); thoracic about 60 degrees and 20 degrees to the coronal plane; L1 to L4 about 90 degrees and 45 degrees to the coronal plane (rotation 1 to 2 degrees per segment); L5 to S1 more coronal. The atlanto-occipital joint is the "yes" joint (about 20 to 25 degrees); C1 to C2 is the "no" joint (about 40 to 45 degrees each way, half of cervical rotation). **Fryette**: type I neutral, opposite sides, groups (scoliosis: bodies rotate toward the convexity); type II flexed or extended, same side, single segment; type III motion in one plane limits the others (the basis of locking).

Gonstead listings: **PRS** is posterior body, spinous right, right side superior (open wedge right); **PI ilium** gives an apparent short leg with a low, prominent PSIS (contact PSIS, drive P to A and I to S); **AS ilium** gives an apparent long leg (contact ischial tuberosity). Screen for **dissection** by history (sudden unusual pain, recent minor trauma, 5 Ds and 3 Ns, Horner, pulsatile tinnitus); positional tests cannot clear anyone. New neurologic signs on the table: stop, keep supine, call emergency services, note the time, monitor, document. Local soreness affects about a third to a half and settles in 24 to 48 hours. **Consent** discloses the impression, procedure, material risks (including stroke), benefits, alternatives and no treatment (reasonable patient standard). PART needs two of four, one being asymmetry or range of motion.



Maitland grades and barriers. Grades are defined by amplitude and by where in the range they act. A grade V thrust goes just past the elastic barrier, where cavitation occurs, and stops well short of the anatomical barrier.

LOCK THESE IN

- Proceed, modify or refer: relative contraindications mean modify, absolute ones mean no thrust at that region.
- Osteoporosis: no prone body weight thrust, rib springing or flexion exercise.
- RA and Down syndrome: ADI over 3 mm (adult) forbids upper cervical thrust; never thrust fused AS segments.
- Pregnancy after 20 weeks: avoid prolonged supine; turn to the left side.
- Flexion distraction for disc and stenosis; instruments for fragile, young and anticoagulated patients.
- Convex on concave glides opposite; concave on convex glides the same way.
- Lower cervical lateral flexion and rotation couple to the same side; scoliotic bodies rotate toward the convexity.
- Dissection is screened by history; on the table, stop, supine, emergency services, time of onset.

Restricted motion and the glide that fixes it

Joint	Restricted motion	Glide
Glenohumeral (convex on concave)	Abduction	Inferior glide of the humeral head
Glenohumeral	Flexion, internal rotation	Posterior glide
Glenohumeral	Extension, external rotation	Anterior glide (not with anterior instability)
Radiocarpal (convex carpals)	Wrist flexion; extension	Dorsal glide; volar glide
Hip (convex head)	Flexion, internal rotation	Posterior glide; long axis distraction for OA
Tibiofemoral (concave tibia)	Knee extension; flexion	Anterior tibial glide; posterior tibial glide
Patellofemoral	Knee flexion	Inferior patellar glide
Talocrural (convex talus)	Dorsiflexion; plantar flexion	Posterior talar glide; anterior glide
Cuboid	Lateral midfoot pain after inversion	Cuboid whip or squeeze (plantar to dorsal)
First MTP (concave phalanx)	Extension (hallux limitus)	Dorsal glide of the proximal phalanx

Facets, coupling and listings

Item	Value	Use
C3 to C7 facets	About 45° to transverse plane	Same side coupling; drive toward the opposite eye
Thoracic facets	About 60° transverse, 20° coronal	PA with slight inferior to superior
L1 to L4 facets	About 90° transverse, 45° coronal	Side posture rotation gaps the joints
Occiput on C1	About 20 to 25° flexion and extension	"Yes" joint
C1 on C2	About 40 to 45° rotation each way	"No" joint; half of cervical rotation
Fryette I	Neutral: opposite sides, group	Scoliosis pattern
Fryette II	Flexed or extended: same side, single segment	Segmental restriction
PRS	Posterior, spinous right, right superior	Contact right spinous; P to A, R to L, S to I
PI ilium	Apparent short leg, low prominent PSIS	Contact PSIS; P to A and I to S
AS ilium	Apparent long leg, high PSIS	Contact ischial tuberosity

Worked cases

WORKED CASE 1 · PROCEED, MODIFY OR REFER

Three patients with mechanical thoracic pain: (a) a 40 year old with no risk factors; (b) a 66 year old with osteopenia, T score −1.9, no fractures; (c) a 72 year old on prednisone for 8 years with new T8 pain after lifting soil and percussion tenderness.

STEP 1 · IS IT MECHANICAL?

All three describe pain changing with movement, but (c) adds a trivial load, steroids and percussion tenderness.

STEP 2 · PATIENT (A)

No contraindication: **proceed** with standard thoracic HVLA.

STEP 3 · PATIENT (B)

Osteopenia is relative: **modify** with instrument, light drop, mobilization, no prone body weight thrust or rib springing.

STEP 4 · PATIENT (C)

Compression fracture until proven otherwise: **no thrust at T8**, lateral thoracic films (MRI if negative and suspicion stays), supportive care; leg weakness would be an emergency.

WORKED CASE 2 · CHOOSING A GLIDE WITH THE CONVEX CONCAVE RULE

A 25 year old soccer player, five weeks after an inversion sprain, cannot squat fully. The knee to wall lunge is 6 cm short on the right, the anterior drawer is firm and there is no bone tenderness.

STEP 1 · CLEAR FRACTURE AND INSTABILITY

He walked in with no bone tenderness (Ottawa negative); a firm drawer means the ligament is stable.

STEP 2 · NAME THE RESTRICTION

Dorsiflexion is lost.

STEP 3 · APPLY THE RULE

The convex talus moves in the concave mortise, so it glides opposite to the roll: dorsiflexion needs a **posterior talar glide**.

STEP 4 · COMPLETE THE PLAN

Posterior glide or long axis distraction thrust, calf stretching, balance and agility work. An anterior glide would be the wrong direction.

WORKED CASE 3 · A STROKE IN EVOLUTION ON THE TABLE

A 39 year old woman has two days of severe right occipital pain, unlike any before, since a sudden head turn while reversing. While being positioned supine she becomes dizzy, her speech slurs and you see horizontal nystagmus.

STEP 1 · RECOGNIZE THE HISTORY

Sudden, unusual, unilateral occipital pain after minor trauma should already have stopped cervical manipulation.

STEP 2 · RECOGNIZE THE SIGNS

Dizziness, dysarthria and nystagmus are posterior circulation signs: vertebral dissection with brainstem ischemia.

STEP 3 · ACT

Do not adjust. Keep her lying down, call emergency services, note the time of onset, monitor vitals and consciousness, nothing by mouth, stay with her.

STEP 4 · DOCUMENT

History, findings, times and actions in detail. Sitting her up "to see if it passes" or testing positions would be wrong.

TRAPS PEOPLE FALL INTO

- **Answering "do not treat" for a relative contraindication.** The best answer is usually a modification: low force, instrument, drop, flexion distraction or mobilization.
- **Clearing the neck with a negative positional test.** DeKleyn, Hautant, George and Maigne cannot clear a patient.
- **Prone thoracic thrust in osteoporosis.** Ribs and vertebrae fracture under prone PA body weight load.
- **Anterior glide for lost dorsiflexion.** The convex talus needs a posterior glide.
- **Thrusting a fused ankylosing spondylitis segment.** It is brittle and fractures with minimal force.
- **Reducing a "pulled elbow" after a fall.** Swelling, bruising or point tenderness means radiographs first: possible supracondylar fracture.
- **Keeping a late pregnancy patient supine.** After about 20 weeks, prolonged supine compresses the vena cava.
- **A consent form that lists only risks.** Disclosure must include benefits, alternatives and the option of no treatment.

Chapter 9 self-test · ten items

1. A 69 year old woman on long term prednisone has new midthoracic pain after coughing, with point tenderness at T9. What should happen before any thoracic adjustment?

A. Flexion exercises to unload the spine

B. Prone crossed pisiform thrust at T9

C. Rib springing to localize the level

D. Thoracic radiographs to exclude a fracture

D. Thoracic radiographs to exclude a fracture Steroid osteoporosis and trivial loading make a compression fracture likely. No prone PA thrust; MRI if films are negative and suspicion remains.

2. A patient with 20 years of RA has a 6 mm atlantodental interval on a flexion film. What is the technique implication?

A. Proceed if the vertebral artery tests are negative
B. Upper cervical thrust is absolutely contraindicated
C. Use rotary thrust but avoid extension only
D. Upper cervical thrust with reduced force is fine

B. Upper cervical thrust is absolutely contraindicated An adult ADI over 3 mm means atlantoaxial instability. Refer for specialist evaluation; no thrust in the region.

3. Which technique best fits a 45 year old with an acute L5 to S1 disc herniation, SLR positive at 35 degrees and no cauda equina signs?

A. Flexion distraction at L5 to S1
B. Heavy rotational side posture thrust
C. Prone lumbar body drop with full force
D. Sacral blocking under both ASIS

A. Flexion distraction at L5 to S1 Flexion distraction lowers intradiscal pressure and opens the foramen with controllable force; heavy rotation may aggravate an acute herniation.

4. Which describes a Maitland grade IV mobilization?

A. A single thrust past the elastic barrier
B. Large amplitude oscillation short of resistance
C. Small amplitude oscillation at the limit of range
D. Small amplitude oscillation at the start of range

C. Small amplitude oscillation at the limit of range Grade IV is small and at the limit, into resistance. Grade V is the thrust.

5. A patient lacks glenohumeral abduction after immobilization. Which glide is indicated?

A. Superior glide of the humeral head
B. Inferior glide of the humeral head
C. Lateral distraction of the scapula
D. Anterior glide of the humeral head

B. Inferior glide of the humeral head The convex head rolls up during abduction and must glide the opposite way, inferiorly.

6. A toddler pulled by the hand now holds the arm flexed and pronated and refuses to use it. There was no fall and no swelling. What fits?

A. Reduce by hyperpronation of the forearm
B. Adjust the radial head posteriorly with force
C. Radiograph for supracondylar fracture first
D. Splint and refer for elbow MRI

A. Reduce by hyperpronation of the forearm This is radial head subluxation; hyperpronation or supination with flexion reduces it. A fall, swelling or bruising would call for films first.

7. In the lower cervical spine a patient laterally flexes left. Which way do the vertebral bodies rotate?

A. Left, with the spinous processes moving left
B. Right, with the spinous processes moving left
C. Left, with the spinous processes moving right
D. They do not rotate in lateral flexion

C. Left, with the spinous processes moving right From C2 to C7 lateral flexion and rotation couple to the same side.

8. Prone, the right PSIS is posterior and low and the right leg appears short. What is the listing?

A. Right AS ilium
B. Left PI ilium
C. Right EX ilium
D. Right PI ilium

D. Right PI ilium A posterior inferior ilium gives an apparent short leg and a low, prominent PSIS on that side. Correct with P to A and I to S drive on the PSIS.

9. A 31 year old at 26 weeks has mechanical low back pain and a normal blood pressure. Which positioning change is most important?

A. Use only supine set ups for safety
B. Treat prone without any cushions
C. Avoid prolonged supine; use side lying
D. Avoid all side posture positions

C. Avoid prolonged supine; use side lying After about 20 weeks, prolonged supine positioning compresses the vena cava; use pregnancy cushions and side lying.

10. What must be disclosed for valid informed consent to cervical manipulation?

A. Only the risk of stroke and its rate
B. Procedure, risks, benefits, alternatives and no treatment
C. Only the diagnosis, the visit plan and the fee schedule
D. Only the common minor side effects

B. Procedure, risks, benefits, alternatives and no treatment Disclosure covers the impression, nature and purpose, material risks including rare stroke, benefits, alternatives and no treatment.

Supportive Interventions

Read it in full: **Chapter 10 in the textbook**. Practice it: **the Study Guide 5 practice exam** and **the flashcards**.

What to know

Choose a modality by three questions: what tissue and how deep, what stage (acute inflammation, repair or remodeling), and what this patient has that forbids it. Modalities are adjuncts; weeks of passive modalities alone is poor care. Universal precautions are impaired sensation, impaired circulation, malignancy in the area, active infection, DVT, damaged skin and inability to communicate. **Cryotherapy** is for the acute stage (about 48 to 72 hours): packs 15 to 20 minutes, ice massage 5 to 10, cold baths 10 to 15; the sequence is cold, burning, aching, numbness. Contraindications: Raynaud phenomenon, cold urticaria, cryoglobulinemia, paroxysmal cold hemoglobinuria, peripheral vascular disease. Prolonged ice over the fibular or ulnar nerve can cause neuropraxia.

Superficial heat suits subacute and chronic stiffness and goes before stretching: moist packs (about 70 to 75 °C, 6 to 8 towel layers, about 20 minutes) heat 1 to 2 cm; paraffin (about 52 to 54 °C) suits hands and feet. Never let a patient lie on a hot pack. **Ultrasound**: 1 MHz reaches about 2.5 to 5 cm (deep), 3 MHz the superficial 1 to 2 cm and heats about three times faster; continuous is thermal, pulsed (20 percent duty) nonthermal; 0.5 to 2.5 W/cm^2, area about twice the ERA, 5 to 10 minutes, head moving. Never over the pregnant uterus, eyes, testes, malignancy, pacemaker, the cord after laminectomy, DVT, infection or cemented joint replacements. Metal implants are not a contraindication.

TENS: high rate (80 to 150 Hz, short pulse, sensory level) for gate control, fast but short relief; low rate (2 to 10 Hz, visible contractions) for endogenous opioids, slower but longer relief. IFC crosses two carriers near 4,000 Hz to make a deep beat; Russian and NMES (2,500 Hz in 50 bursts per second, 10 on and 50 off) strengthen muscle; iontophoresis drives dexamethasone from the negative pole and lidocaine from the positive. No electrical stimulation with a demand pacemaker or defibrillator, over the carotid sinus, anterior neck, heart, pregnant uterus, DVT or malignancy. **Traction**: cervical about 20 to 30 lb to separate, neck in 20 to 30 degrees of flexion for lower levels, occipital wedge preferred; lumbar needs about 25 percent of body weight to

overcome friction and about 50 percent to separate. Laser runs about 600 to 1,000 nm with eye protection; diathermy is contraindicated with metal implants.

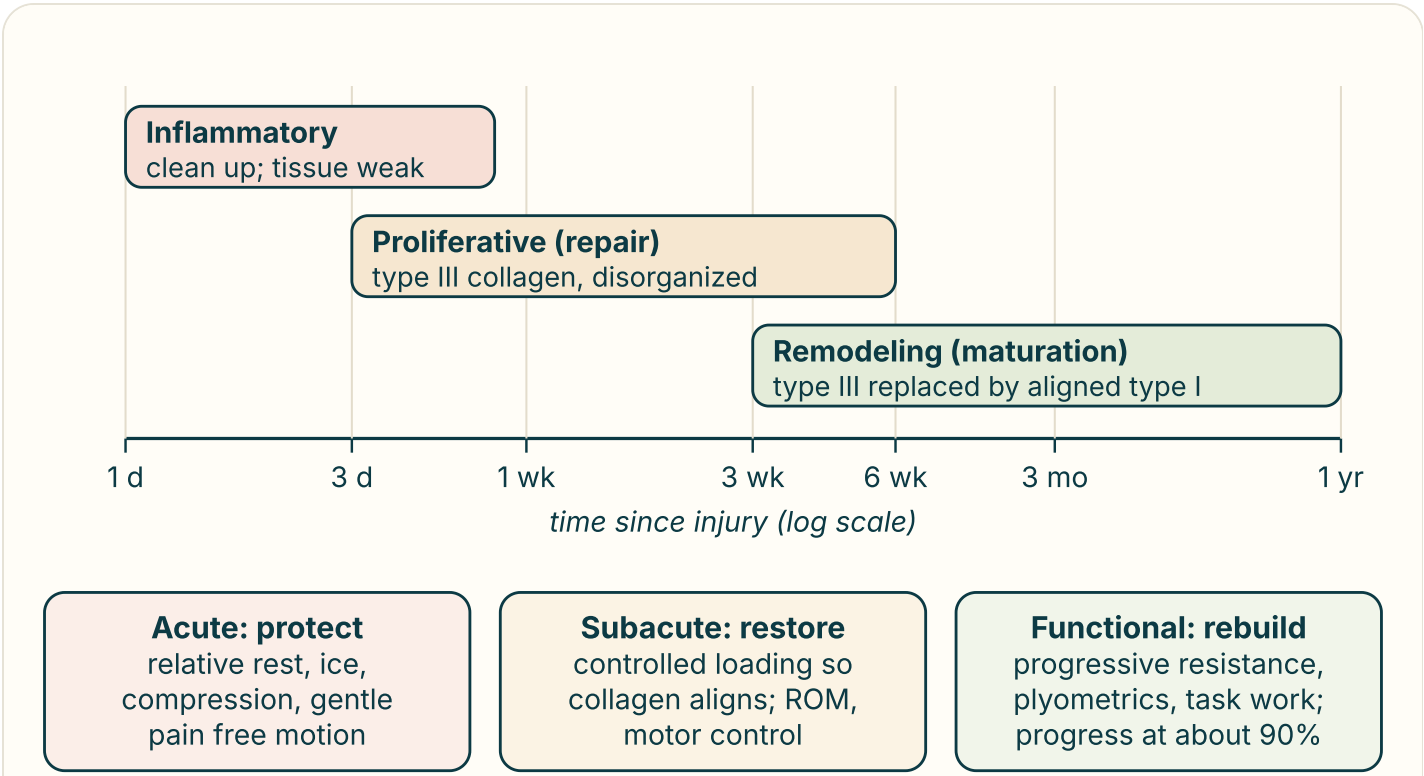
Nutrition advice stays general within state law; medical nutrition therapy belongs to a dietitian. Teach patterns: the **Mediterranean** diet has the strongest evidence; DASH lowers blood pressure. Supplements with support: vitamin D for deficiency (adult upper limit 4,000 IU), calcium to fill the gap to 1,000 to 1,200 mg, omega 3 (about 2.5 to 3 g EPA and DHA) for rheumatoid arthritis, creatine with resistance training, B12 for deficiency, protein about 1.0 to 1.2 g/kg in older adults and 1.2 to 2.0 in athletes. Glucosamine and curcumin show little or small benefit. **Warfarin** interactions: vitamin K lowers the INR (advise consistency); fish oil, ginkgo, garlic, ginger, vitamin E, dong quai and turmeric raise bleeding risk; St. John's wort lowers warfarin and contraceptive levels and causes serotonin syndrome with SSRIs; red yeast rice is a natural statin.

Bone health: calcium 1,000 mg (1,200 for women over 50 and men over 70), vitamin D 600 IU to age 70 and 800 after (25 hydroxyvitamin D under 20 ng/mL is deficient). **Calcium carbonate** needs acid and food; **calcium citrate** suits patients on PPIs; split doses over 500 mg. B6 over about 100 mg a day for months causes neuropathy; vitamin A excess causes birth defects. Weight: BMI thresholds 18.5, 25, 30, 35, 40; waist over 102 cm (men) or 88 cm (women); a 5 to 10 percent loss improves BP, glucose and OA pain; a deficit of 500 to 750 kcal a day loses about 0.5 to 0.75 kg a week. Refer weight loss over 5 percent in 6 to 12 months, eating disorder signs, RED-S and suspected celiac disease (test before going gluten free).

Healing: inflammatory (about the first 3 to 6 days), proliferative (about day 3 to week 3 to 6, type III collagen) and remodeling (week 3 to a year or more, type I collagen). Rehab follows: protect, restore motion and motor control, then build strength, with return at about 90 percent of the other side. Multifidus atrophy after back pain persists unless retrained; the McGill big three (curl up, side bridge, bird dog) build endurance. **McKenzie**: derangement centralizes with repeated movement in the directional preference; dysfunction hurts only at end range; postural syndrome hurts only with sustained loading. Centralization means continue; peripheralization means stop. Static stretch about 30 seconds, 2 to 4 reps. Dose: endurance under 50 percent 1RM for 15 to 25 reps; novice strength 60 to 70 percent for 8 to 12; maximal strength 80 percent or more for up to 6.

Lifting: keep the load close, hip hinge, brace and turn with the feet; avoid heavy flexion in the first hour after rising. The NIOSH equation starts at 23 kg (51 lb). Workstation: chair first, keyboard at elbow height, monitor about an arm's length away with the top at or below eye level (lower for progressive lenses), and move every 30 to 60 minutes (20 20 20 for the eyes). Avoid prone sleeping for neck pain. Stay active rather than bed rest. After about 12 weeks off, return to that job becomes much less likely; return early with functional restrictions and screen yellow, blue and black flags.

Exercise: 150 to 300 minutes of moderate or 75 to 150 of vigorous activity a week plus strength on 2 or more days. Moderate is RPE about 12 to 13, vigorous 14 to 17; maximum HR is about 220 minus age; **Karvonen** target = resting HR + percentage × (max − resting), 40 to 59 percent moderate, 60 to 89 vigorous; beta blockers mean using RPE. Exertional chest symptoms need medical clearance first. Tobacco: the **5 As** (ask, advise, assess, assist, arrange) and the 5 Rs for the unwilling. A standard drink is about 14 g of alcohol; screen with AUDIT-C or CAGE. Sleep 7 or more hours; STOP-BANG for apnea; PHQ-2 for mood and 988 for crisis. Match counseling to the **stage of change**: information in precontemplation, motivational interviewing (OARS) in contemplation, SMART plans in preparation and action, relapse prevention in maintenance.



Healing sets the rehab plan. The phases overlap. Protect in the inflammatory phase, load with control in the repair phase so new collagen lines up, and build strength and skill through the long remodeling phase. Tendon and ligament take longer than muscle.

LOCK THESE IN

- Ice acute (15 to 20 min); heat subacute; no cold in Raynaud, cold urticaria or cryoglobulinemia.
- Ultrasound 1 MHz deep, 3 MHz shallow; continuous thermal, pulsed nonthermal; metal implants are not a contraindication.
- High rate TENS for gate control; low rate for endorphins; no e-stim with a demand pacemaker.
- Lumbar traction: about 25% of body weight overcomes friction, about 50% separates.
- Warfarin: vitamin K lowers INR; ginkgo, fish oil, garlic, vitamin E raise bleeding; St. John's wort lowers warfarin.
- Calcium citrate for patients on PPIs; split doses over 500 mg.
- Centralization means continue the direction; peripheralization means stop.
- Karvonen: resting + % of (max − resting); exertional chest symptoms need clearance first.

Modality settings and contraindications

Modality	Parameters	Never use with
Ice pack	15 to 20 min; acute stage	Raynaud, cold urticaria, cryoglobulinemia, PVD
Moist heat	70 to 75 °C pack, 6 to 8 layers, about 20 min	Acute inflammation, bleeding, DVT, malignancy, pregnant low back
Paraffin	About 52 to 54 °C, dip and wrap	Open wounds, impaired sensation
Ultrasound	1 MHz deep (2.5 to 5 cm); 3 MHz shallow (1 to 2 cm); 0.5 to 2.5 W/cm^2	Pregnant uterus, eyes, testes, tumor, pacemaker, DVT, cemented joints
High rate TENS	80 to 150 Hz, 50 to 100 µs, sensory	Demand pacemaker, carotid sinus, anterior neck
Low rate TENS	2 to 10 Hz, motor level	Same as above; pregnant uterus
IFC	Carriers near 4,000 Hz, beat 1 to 150 Hz	Same as electrical stimulation
NMES (Russian)	2,500 Hz, 50 bursts/s, 10 s on, 50 s off	Same as electrical stimulation
Iontophoresis	40 to 80 mA·min	Dexamethasone (−), lidocaine (+)
Cervical traction	10 to 15 lb start; 20 to 30 lb to separate	Instability, tumor, infection, vertebral artery disease
Lumbar traction	25% body weight friction; 50% to separate	Pregnancy, instability, severe osteoporosis
Laser	About 600 to 1,000 nm, J/cm^2	Eyes, malignancy, thyroid, pregnant uterus

Doses, targets and screens

Item	Value	Note
Calcium	1,000 mg; 1,200 women over 50, men over 70	Citrate with PPIs
Vitamin D	600 IU to 70; 800 IU after; UL 4,000 IU	Deficient under 20 ng/mL
Protein	Older adults 1.0 to 1.2 g/kg; athletes 1.2 to 2.0	Supervise in kidney disease
BMI	18.5, 25, 30, 35, 40	Waist over 102 cm men, 88 cm women
Weight loss	500 to 750 kcal/day deficit: about 0.5 to 0.75 kg/week	5 to 10% loss is meaningful
Endurance	Under 50% 1RM, 15 to 25 reps	Short rest
Novice strength	60 to 70% 1RM, 8 to 12 reps	2 to 3 days a week
Activity	150 to 300 min moderate or 75 to 150 vigorous	Strength 2+ days
Karvonen	Resting + % × (220 − age − resting)	40 to 59% moderate; 60 to 89% vigorous
Standard drink	About 14 g alcohol	Men 2, women 1 per day
Lifting	NIOSH load constant 23 kg (51 lb)	Keep load close

Worked cases

WORKED CASE 1 · A KARVONEN TARGET RANGE

A 50 year old woman with a resting heart rate of 70 is cleared for exercise. What is her moderate intensity target range?

STEP 1 · MAXIMUM HR

220 − 50 = 170.

STEP 2 · HEART RATE RESERVE

170 − 70 = 100.

STEP 3 · APPLY 40 AND 59 PERCENT

70 + 0.40 × 100 = 110; 70 + 0.59 × 100 = 129.

STEP 4 · ANSWER AND CAUTION

Target **110 to 129 beats per minute**. If she takes a beta blocker, use RPE about 12 to 13 instead.

WORKED CASE 2 · LUMBAR TRACTION FORCE

An 80 kg man with radicular pain is placed on a non split lumbar traction table. How much force overcomes friction, and how much separates the vertebrae?

STEP 1 · FRICTION

About 25 percent of body weight: 0.25 × 80 = **20 kg**.

STEP 2 · SEPARATION

About 50 percent of body weight: 0.50 × 80 = **40 kg**.

STEP 3 · REDUCE THE FRICTION

A split table removes most of the friction, so less total force is needed.

STEP 4 · SCREEN FIRST

Exclude instability, tumor, infection, severe osteoporosis, cord compression and pregnancy.

WORKED CASE 3 · A WARFARIN PATIENT WITH A SUPPLEMENT LIST

A 62 year old on warfarin has knee OA, has started ginkgo, and plans to add high dose fish oil, turmeric and glucosamine. He has new forearm bruises.

STEP 1 · FLAG THE INTERACTIONS

Ginkgo, fish oil and turmeric add bleeding risk; glucosamine may raise the INR.

STEP 2 · READ THE BRUISING

New bruising suggests over anticoagulation.

STEP 3 · ACT

Stop the ginkgo, add nothing new, and send a note to the prescriber for an INR check. No deep soft tissue work until the bruising is explained.

STEP 4 · OFFER WHAT WORKS

Weight loss if overweight, quadriceps and hip strengthening, walking or cycling, education.

WORKED CASE 4 · MCKENZIE CLASSIFICATION

A 38 year old has three weeks of low back pain into the right buttock and posterior thigh, worse sitting. Ten prone press ups abolish the thigh pain, leaving central pain; repeated sitting flexion sends it back to the thigh.

STEP 1 · WATCH THE RESPONSE

Extension centralizes; flexion peripheralizes.

STEP 2 · CLASSIFY

A rapid change with repeated movement is a **derangement** with an extension directional preference.

STEP 3 · PRESCRIBE

Prone press ups every 2 to 3 hours, avoid slumped sitting, use a lumbar roll, then progress to standing extension and stabilization.

STEP 4 · SET THE SAFETY NET

Worsening leg pain or a neurologic deficit changes the plan to imaging or referral.

TRAPS PEOPLE FALL INTO

- **Heat on a fresh sprain.** Heat increases blood flow and edema. Protect, compress, elevate and use short bouts of ice.
- **Calling metal implants a contraindication to ultrasound.** They are not. They are a contraindication to diathermy.
- **Electrical stimulation with a demand pacemaker.** Use heat, manual therapy and exercise instead.
- **Calcium carbonate for a patient on a PPI.** Citrate is absorbed without acid.
- **Going gluten free before testing.** Serology and biopsy normalize on the diet; test first.
- **Continuing a direction that peripheralizes.** Stop it and test the opposite direction.
- **Starting a "gentle" walking program with exertional chest tightness.** Medical evaluation comes before any exercise.
- **Giving a quit plan to a precontemplator.** Offer brief personal information and leave the door open.

Chapter 10 self-test · ten items

1. Which ultrasound frequency best suits plantar fasciitis?

A. 1 MHz, reaching about 5 cm deep
B. 3 MHz, absorbed in the top 1 to 2 cm
C. 1 MHz pulsed at a 20 percent duty
D. 0.5 MHz at the highest intensity

B. 3 MHz, absorbed in the top 1 to 2 cm 3 MHz is absorbed superficially and suits shallow targets such as the plantar fascia. 1 MHz is for deep tissue.

2. A patient with Raynaud phenomenon has an acute wrist sprain. Which modality is contraindicated?

A. Cryotherapy
B. Elevation of the limb
C. Compression wrap
D. Gentle range of motion

A. Cryotherapy Cold can trigger vasospasm in Raynaud phenomenon.

3. Which TENS settings rely mainly on endogenous opioid release?

A. 4,000 Hz carriers with a beat
B. A 2,500 Hz carrier in 50 bursts per second
C. 2 to 10 Hz with strong motor contractions
D. 80 to 150 Hz at sensory level

C. 2 to 10 Hz with strong motor contractions Low rate, acupuncture like TENS releases endorphins; relief starts slowly and lasts longer.

4. A 76 year old with a demand pacemaker asks for "electric therapy" for neck pain. What is appropriate?

A. Russian stimulation at a low intensity
B. Interferential current away from the chest
C. High rate TENS over the upper trapezius only
D. Decline e-stim; use heat, manual care and exercise

D. Decline e-stim; use heat, manual care and exercise Electrical stimulation can inhibit or trigger a demand pacemaker.

5. About what force separates lumbar vertebrae with mechanical traction?

A. About 50 percent of body weight
B. About 25 percent of body weight
C. About 10 percent of body weight
D. About 100 percent of body weight

A. About 50 percent of body weight About 25 percent only overcomes friction; about 50 percent separates the vertebrae.

6. A patient on warfarin wants St. John's wort for low mood. What is the main concern?

A. It raises warfarin levels, risking bleeding
B. It has no known drug interactions
C. It lowers warfarin levels, risking clotting
D. It only interacts with calcium supplements

C. It lowers warfarin levels, risking clotting St. John's wort induces CYP3A4, reducing warfarin effect; it also causes serotonin syndrome with SSRIs. Refer the mood complaint and screen with the PHQ-2.

7. A 65 year old on a PPI for six years asks which calcium to buy. What fits best?

A. Calcium carbonate in one 1,200 mg dose
B. Calcium citrate in split doses
C. Calcium carbonate on an empty stomach
D. No calcium; vitamin A instead

B. Calcium citrate in split doses Citrate does not need stomach acid. Doses over 500 mg absorb better when split.

8. During repeated standing flexion, calf pain spreads further down the leg. What should you do?

A. Continue flexion to break adhesions
B. Ignore it and add traction
C. Add sitting flexion to the program
D. Stop flexion and test extension

D. Stop flexion and test extension Peripheralization means the wrong direction. Centralization identifies the directional preference.

9. A 60 year old with resting HR 80 wants a moderate target. Using Karvonen at 40 to 59 percent, what is the range?

A. 96 to 118 beats per minute
B. 112 to 127 beats per minute
C. 104 to 132 beats per minute
D. 120 to 140 beats per minute

B. 112 to 127 beats per minute Max 220 − 60 = 160; reserve 160 − 80 = 80; 80 + 0.40 × 80 = 112; 80 + 0.59 × 80 = 127.

10. A roofer says, "I've thought about quitting smoking since my dad's heart attack, but it's the only thing that calms me down." Which approach fits?

A. Give a firm lecture on lung cancer
B. Set a quit date for next Monday
C. Drop the subject until he raises it again himself
D. Motivational interviewing to explore ambivalence

D. Motivational interviewing to explore ambivalence He is in contemplation. Reflect both sides and elicit change talk before planning.

ONE PAGE

Cram sheet

Everything from chapters 9 and 10 in one place. Cover the right column and see if you can rebuild each row.

Numbers to know

Item	Value	Note
ADI	Over 3 mm adult, 5 mm child	Upper cervical thrust contraindicated
Warfarin INR	Usually 2 to 3 (to 3.5 some valves)	Above range or bruising: no thrust
Pregnancy	Avoid prolonged supine after about 20 weeks	Preeclampsia 140/90+ after 20 weeks
Facets	C 45°, T 60° (20° coronal), L 90° (45° coronal)	To the transverse plane
Upper cervical	Occiput-C1 20 to 25°; C1-C2 40 to 45° each way	"Yes" and "no" joints
Soreness after care	About a third to a half; 24 to 48 h	Expected, self limited
Ice	15 to 20 min pack; 5 to 10 ice massage	Acute 48 to 72 h
Moist heat	70 to 75 °C, 6 to 8 layers, about 20 min	Heats 1 to 2 cm
Ultrasound	1 MHz 2.5 to 5 cm; 3 MHz 1 to 2 cm	0.5 to 2.5 W/cm^2, 5 to 10 min
TENS	High 80 to 150 Hz; low 2 to 10 Hz	Gate control versus endorphins
Traction	Cervical 20 to 30 lb; lumbar 25% friction, 50% separation	Neck 20 to 30° flexion for lower levels
Calcium and D	1,000 to 1,200 mg; 600 to 800 IU; UL 4,000 IU	Citrate with PPIs
Healing	Inflammatory to about day 6; repair day 3 to week 6; remodel week 3 to 1 yr+	Return at about 90%
Dosing	Endurance under 50% 1RM 15 to 25; novice 60 to 70% 8 to 12	Max strength 80%+ up to 6
Stretch	About 30 s, 2 to 4 reps	Older adults up to 60 s
Activity	150 to 300 min moderate; strength 2+ days	RPE 12 to 13 moderate
Return to work	After about 12 weeks off, return falls sharply	Modified duty early

Item	Value	Note
NIOSH	Load constant 23 kg (51 lb)	

Formulas

Name	Formula	Note
Max heart rate	220 − age	Beta blockers: use RPE
Karvonen target	resting + % × (max − resting)	40 to 59% moderate
Traction	0.25 × body weight friction; 0.50 × separation	Lumbar
BMI	kg ÷ m^2	18.5, 25, 30, 35, 40
Weight loss	500 to 750 kcal/day deficit	About 0.5 to 0.75 kg/week

Key terms and comparisons

Pair	How to tell them apart
Absolute vs relative	No thrust at that region versus modify force, position, technique.
Convex vs concave moving	Convex glides opposite; concave glides the same way.
Fryette I vs II	Neutral, opposite sides, group versus flexed or extended, same side, single segment.
PI vs AS ilium	Apparent short leg, low PSIS versus apparent long leg, high PSIS.
Continuous vs pulsed ultrasound	Thermal versus nonthermal.
Carbonate vs citrate	Needs acid and food versus absorbed without acid.
Centralization vs peripheralization	Continue the direction versus stop it.
Precontemplation vs contemplation	Information and an open door versus motivational interviewing.

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What to know, worked cases and self-tests for Study Guide 5 · Chapters 9 and 10.
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