PART II CLINICAL SCIENCES · BOARD REVIEW

Study Guide 5

This guide covers the principles of chiropractic. Chapter 9 is history, the paradigm and philosophy, research methods and the evidence base. Chapter 10 is subluxation models, the basic science of the motion segment, what a thrust does, adverse events and applied principles of care. You will learn the names and dates the board loves, how to read a study and its statistics, and how to describe each model with the evidence that supports it. Work one chapter at a time, and finish each with its ten board-style items.

WHAT THIS GUIDE COVERS

- Chapter 9 · D.D. and B.J. Palmer, the first adjustment, early figures, Morikubo, licensure, accreditation, Wilk, research milestones, schools of thought, the consensus paradigm, vitalism and Innate, Stephenson's principles, homeostasis, Selye, the triad of health, PICO, study designs, GRADE, bias, reliability and validity, diagnostic accuracy, statistics, the evidence for SMT, scope and evidence informed practice.
- Chapter 10 · medical and chiropractic subluxation, Medicare and PART, related terms, the vertebral subluxation complex, joint receptors, gate control, facilitation, dysafferentation, nerve compression, somatovisceral and viscerosomatic reflexes, axoplasmic, neuroimmune and vascular models, the motion segment, facet orientation, coupling, IAR, disc and ligament mechanics, Sandoz zones, healing and immobilization, the thrust, cavitation, adverse events, phases of care, prevention and behavior change.

CHAPTER 9

The Chiropractic Paradigm, History and Research Principles

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

What to know

D.D. Palmer (1845 to 1913), a magnetic healer in Davenport, Iowa, gave the first adjustment on **September 18, 1895** to **Harvey Lillard**, a janitor with about 17 years of impaired hearing, using the spinous process of an upper thoracic vertebra (traditionally about T4) as a lever. The word

chiropractic was coined in 1896 with Rev. **Samuel Weed**, from cheir (hand) and praxis (practice): "done by hand." Teaching began in 1897.

D.D. Palmer's ideas (The Chiropractor's Adjuster, 1910): health is normal **tone**, and disease is too much or not enough function; displaced vertebrae impinge nerves; **Innate** intelligence runs self regulation as an expression of Universal Intelligence; the three causes of subluxation are traumas, toxins and autosuggestion (thoughts). He was jailed in 1906 for practicing medicine without a license and sold the school to his son.

B.J. Palmer (1882 to 1961) is the developer: spinography (x-ray, about 1910), the neurocalometer (1924), the meric system (later abandoned), the upper cervical Hole in One (HIO) toggle recoil focus from the 1930s, "straight" chiropractic and the ICA (1926). He described the Safety Pin Cycle of mental impulses. Others: Langworthy (Modernized Chiropractic, 1906, the IVF and adjuncts), Oakley Smith (founded naprapathy), John Howard (leading mixer school), Willard Carver (structural approach), Tom Morris (won Morikubo), R.W. Stephenson (33 principles, 1927), Joseph Janse (science and accreditation).

Legal history: in the **Morikubo case (1907)**, Tom Morris argued chiropractic had its own philosophy and method, distinct from osteopathy, and won; philosophy became a legal shield. Licensure ran from **Kansas (1913)** to **Louisiana (1974)**. Basic science laws from the 1920s pushed education toward science. NBCE formed in 1963; CCE was recognized in 1974; Medicare coverage was legislated in 1972 (effective 1973), with the x-ray requirement dropped in 2000. In **Wilk v. AMA** (filed 1976, decided 1987, upheld 1990) a federal court found an unlawful conspiracy to boycott chiropractors.

Research milestones: a 1975 federal conference on SMT; the 1991 appropriateness study; the **Mercy guidelines** (1992); the **Manga report** (1993, Ontario, effective and cost effective); the 1994 AHCPR acute low back guideline listing manipulation in the first month; WHO guidelines on training and safety (2005).

Schools of thought: **straight** (adjusting only, philosophy central), **mixer** (broad portal of entry care with adjuncts), **objective straight** (subluxation correction only, not treatment of any

condition, from the 1970s) and **reform or evidence based** (spine and musculoskeletal specialty grounded in research). Most practitioners sit in the middle.

The 1996 **consensus paradigm**: emphasis on the body's inherent recuperative power without drugs or surgery; structure (primarily the spine) and function coordinated by the nervous system; purpose to optimize health; practice includes **establishing a diagnosis**; chiropractors are portal of entry providers who must diagnose and refer. **Vitalism** contrasts with mechanism; vis medicatrix naturae is its Hippocratic root. Stephenson's **33 principles** are deductive from a major premise (Universal Intelligence); the triune of life is intelligence, force and matter; principle 24, the **limits of adaptation**, says Innate is limited by the limitations of matter, which supports referral. Holism and the structure function relationship (Wolff's law for bone, Davis's law for soft tissue) are shared with osteopathy.

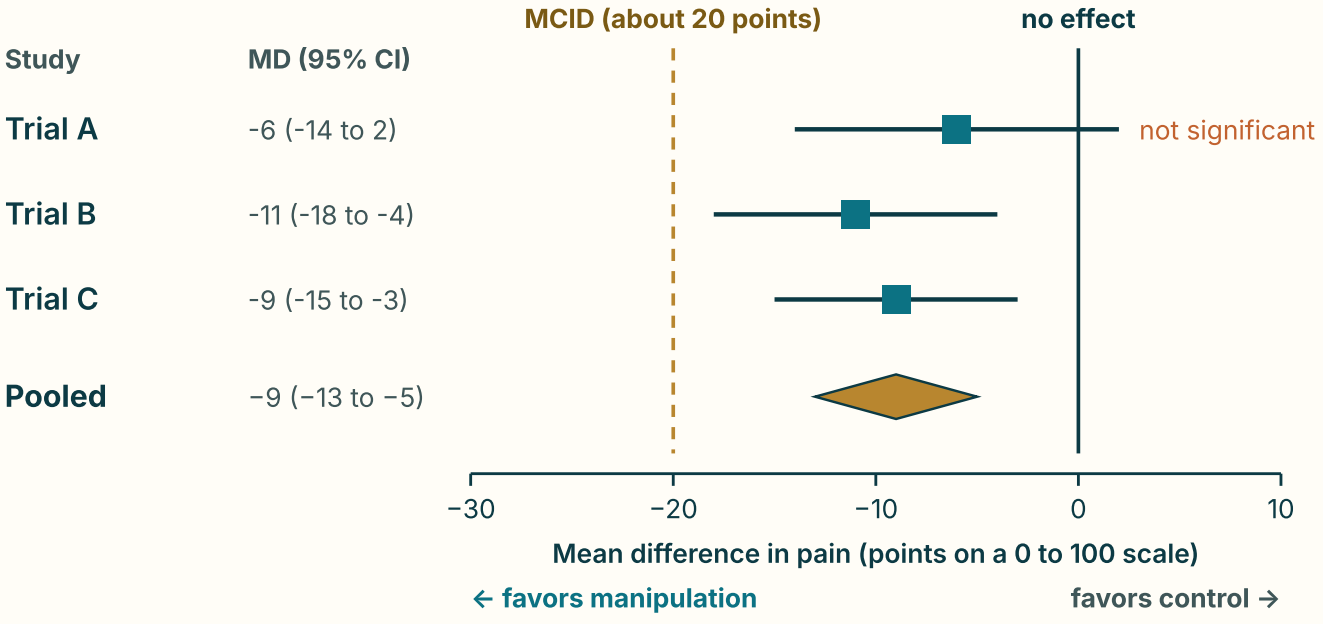
Physiology links: homeostasis (Cannon, after Bernard) by negative feedback; allostasis and allostatic load; **Selye's general adaptation syndrome** of alarm, resistance and exhaustion; the **triad of health** (structural, chemical, mental) parallels traumas, toxins and autosuggestion and overlaps Engel's 1977 biopsychosocial model.

Research design: frame questions with **PICO**. Therapy questions are answered best by RCTs and their systematic reviews; prognosis by cohorts; rare harms by case control (odds ratio) or case crossover; diagnosis by cross sectional accuracy studies. **GRADE** starts RCTs high and observational studies low, downgrades for risk of bias, inconsistency, indirectness, imprecision and publication bias, and upgrades for large effect, dose response or confounding that would reduce the effect. **Concealed allocation** prevents selection bias; blinding prevents performance and detection bias; intention to treat preserves randomization. Regression to the mean, favorable natural history and contextual effects inflate uncontrolled studies.

Reliability and validity: kappa corrects agreement for chance (0.21 to 0.40 fair, 0.41 to 0.60 moderate, 0.61 to 0.80 substantial); ICC for continuous measures. Intraexaminer beats interexaminer reliability; **pain provocation is more reliable than motion palpation**, which is slight to fair. A test must be reliable to be valid, but reliability does not ensure validity. Validity types: face, content, criterion (concurrent, predictive), construct. MCIDs: about 2 points or 30% on the NPRS, about 10 points on the Oswestry, about 5 of 50 on the NDI.

Statistics: LR+ = sensitivity ÷ (1 − specificity); LR− = (1 − sensitivity) ÷ specificity; LRs of 2, 5 and 10 raise probability about 15, 30 and 45 points. In a positively skewed distribution, mean > median > mode. The p value is the probability of results this extreme if the null is true; type I error is a false positive (alpha), type II a false negative (beta); power = 1 − beta, usually 0.80. A 95% CI crossing 0 (difference) or 1 (ratio) is not significant. RR, RRR, **ARR** (CER − EER) and **NNT** (1 ÷ ARR). Statistical significance is not clinical importance. Reporting checklists: CONSORT (trials), PRISMA (reviews), STROBE (observational), STARD (diagnostic).

Evidence: SMT gives **modest short term benefit** (about 10 points on a 100 point pain scale) for acute and chronic low back pain, similar to other recommended therapies; neck pain grades I and II (best with exercise); and cervicogenic headache. Evidence is limited for migraine, tension type headache, radiculopathy and extremities, and absent or negative for asthma, hypertension, dysmenorrhea, infantile colic and otitis media. A 2017 internal medicine guideline lists SMT as a first line nonpharmacologic option. Scope: portal of entry, diagnose and refer, no drugs or surgery. Sackett's evidence based practice combines research evidence, clinical expertise and patient values; the five steps are ask, acquire, appraise, apply, assess. The four ethics principles are autonomy, beneficence, nonmaleficence and justice.



Illustrative numbers. The pooled diamond misses 0 (significant) but stops short of the MCID (modest).

Significant is not the same as important. A trial whose interval crosses 0 is not significant alone. Pooling narrows the interval, but here the effect still falls short of the MCID: real but modest, the usual finding for SMT.

LOCK THESE IN

- Palmer, Lillard, September 18, 1895, Davenport, upper thoracic, deafness; Weed coined cheir plus praxis.
- D.D.: tone, Innate, traumas, toxins, autosuggestion. B.J.: x-ray, neurocalometer, HIO, straight.
- Morikubo 1907: philosophy as legal defense. Wilk 1987: antitrust and a boycott.
- Kansas 1913 first license, Louisiana 1974 last; NBCE 1963; CCE 1974.
- Limits of adaptation: Innate is limited by matter, so diagnose and refer.
- Concealed allocation stops selection bias; blinding stops performance and detection bias.
- Motion palpation has poor to fair interexaminer kappa; pain provocation is more reliable.
- NNT = 1 ÷ ARR. SMT effect is modest and short term, similar to other recommended care.

History at a glance

Year	Event	Why it matters
1895	First adjustment, Harvey Lillard	Origin of chiropractic
1896	Name coined with Rev. Samuel Weed	Cheir plus praxis
1906	D.D. jailed; UCA formed; Modernized Chiropractic	Legal defense and early splits
1907	Morikubo acquitted	Distinct philosophy as legal shield
1913	Kansas licenses chiropractic	First state
1963	NBCE established	Standard national exams
1972 to 1974	Medicare; CCE recognized; Louisiana licenses	Coverage, accreditation, all states
1987	Wilk v. AMA decided	Boycott found unlawful
1992 to 1994	Mercy guidelines, Manga report, AHCPR guideline	Entry into guidelines

Research formulas

Measure	Formula	Example
LR+	Sens ÷ (1 − spec)	0.90 ÷ 0.20 = 4.5
LR−	(1 − sens) ÷ spec	0.10 ÷ 0.80 = 0.125
Relative risk	EER ÷ CER	0.30 ÷ 0.40 = 0.75
RRR	1 − RR	25%
ARR	CER − EER	10 percentage points
NNT	1 ÷ ARR	1 ÷ 0.10 = 10
Odds ratio	(a × d) ÷ (b × c)	Case control studies
Kappa	(observed − chance) ÷ (1 − chance)	0.21 to 0.40 fair
Power	1 − beta	Conventionally 0.80
Cohen d	Mean difference ÷ pooled SD	0.2 small, 0.5 medium, 0.8 large

Worked cases

WORKED CASE 1 · NNT FROM A TRIAL

In a trial, 40% of controls and 30% of manipulated patients still had disabling pain at 4 weeks.

STEP 1 · RELATIVE RISK

RR = 0.30 ÷ 0.40 = **0.75**.

STEP 2 · RELATIVE RISK REDUCTION

RRR = 1 − 0.75 = **25%**.

STEP 3 · ABSOLUTE RISK REDUCTION

ARR = 0.40 − 0.30 = **0.10**, 10 percentage points.

STEP 4 · NUMBER NEEDED TO TREAT

NNT = 1 ÷ 0.10 = **10**: treat 10 patients for one more to avoid disabling pain.

READ IT CRITICALLY

A 25% relative reduction sounds larger than a 10 point absolute one. Always ask for the ARR and compare the effect with the MCID.

WORKED CASE 2 · LIKELIHOOD RATIOS TO POST-TEST PROBABILITY

A test has sensitivity 90% and specificity 80%. Your pretest probability for the condition is 30%.

STEP 1 · LR+

0.90 ÷ (1 − 0.80) = 0.90 ÷ 0.20 = **4.5**.

STEP 2 · LR−

(1 − 0.90) ÷ 0.80 = 0.10 ÷ 0.80 = **0.125**.

STEP 3 · POSITIVE RESULT

Pretest odds = 0.30 ÷ 0.70 = 0.43. Post-test odds = 0.43 × 4.5 = 1.93. Probability = 1.93 ÷ 2.93 = **66%**.

STEP 4 · NEGATIVE RESULT

Post-test odds = 0.43 × 0.125 = 0.054. Probability = 0.054 ÷ 1.054 = **5%**.

CHECK WITH THE RULE OF THUMB

An LR near 5 raises probability about 30 points (30% to about 60%); an LR near 0.1 lowers it about 45 points. The exact math agrees.

WORKED CASE 3 · KAPPA FOR MOTION PALPATION

Two examiners palpate 100 segments for fixation. Both say fixated on 20, both say not fixated on 50, and they disagree on 30 (15 each way).

STEP 1 · OBSERVED AGREEMENT

(20 + 50) ÷ 100 = **0.70**.

STEP 2 · CHANCE AGREEMENT

Each examiner calls 35% fixated. Chance = 0.35 × 0.35 + 0.65 × 0.65 = 0.1225 + 0.4225 = **0.545**.

STEP 3 · KAPPA

(0.70 − 0.545) ÷ (1 − 0.545) = 0.155 ÷ 0.455 = **0.34**.

STEP 4 · INTERPRET

0.21 to 0.40 is **fair** agreement, typical of interexaminer motion palpation. 70% raw agreement looked good, but much of it was chance.

WORKED CASE 4 · CHOOSING THE RIGHT STUDY DESIGN

You want to know whether cervical manipulation is linked to vertebrobasilar stroke, an event that is very rare.

STEP 1 · RULE OUT A TRIAL

An RCT would need millions of participants to capture enough strokes, so it is not practical.

STEP 2 · PICK A RARE EVENT DESIGN

A **case control** or **case crossover** design starts with people who had the outcome and looks back for exposure.

STEP 3 · KNOW THE WEAKNESS

Case crossover studies are open to protopathic bias: an early dissection causes neck pain that prompts the visit.

STEP 4 · READ THE ACTUAL RESULT

Stroke patients were as likely to have seen a primary care physician as a chiropractor, so a causal link has not been established.

TRAPS PEOPLE FALL INTO

- **Mixing up Morikubo and Wilk.** Morikubo (1907) used philosophy as a defense against practicing osteopathy. Wilk (1987) was an antitrust ruling on a medical boycott.
- **Calling B.J. Palmer the founder.** D.D. is the discoverer or founder; B.J. is the developer.
- **Treating the paradigm as adjusting only.** The consensus paradigm includes establishing a diagnosis. Portal of entry means a duty to diagnose and refer.
- **Thinking blinding prevents selection bias.** Concealed allocation does that. Blinding prevents performance and detection bias.
- **Assuming a reliable test is valid.** Two examiners can agree and both be wrong. Reliability is necessary but not sufficient.
- **Reading p under 0.05 as clinically important.** Compare the effect and its confidence interval with the MCID.
- **Quoting RRR alone.** Relative reductions look large. ARR and NNT tell the real size of benefit.
- **Claiming SMT helps asthma or immunity.** Evidence is absent or negative for visceral conditions and immunity claims are considered misleading.

Chapter 9 self-test · ten items

1. Who received the first chiropractic adjustment, and for what complaint?

A. Samuel Weed, for chronic headaches
B. B.J. Palmer, for a heart complaint
C. Harvey Lillard, for impaired hearing
D. Shegataro Morikubo, for neck pain

C. Harvey Lillard, for impaired hearing D.D. Palmer adjusted Harvey Lillard on September 18, 1895, for hearing loss of about 17 years.

2. Which contribution belongs to B.J. Palmer rather than to D.D. Palmer?

A. The concept of tone in the nerves
B. The first adjustment in 1895
C. Traumas, toxins and autosuggestion
D. The Hole in One upper cervical focus

D. The Hole in One upper cervical focus B.J. developed the HIO upper cervical focus, spinography and the neurocalometer. Tone and the three Ts are D.D.'s ideas.

3. What was the legal significance of the 1907 Morikubo case?

A. Philosophy made chiropractic distinct
B. Medicare began covering adjustments
C. Medicine's boycott was found unlawful
D. Kansas passed the first license law

A. Philosophy made chiropractic distinct Tom Morris argued chiropractic had its own philosophy and method, distinct from osteopathy, and won an acquittal.

4. Which of Stephenson's principles most directly supports referral of a patient with a vertebral tumor?

A. Triune of life
B. Limits of adaptation
C. Law of demand and supply
D. Normality of Innate

B. Limits of adaptation The limits of adaptation principle says Innate is limited by the limitations of matter, so a tumor or fracture needs other care.

5. Which design is best suited to study a very rare adverse event after manipulation?

A. A cross sectional survey
B. A randomized trial
C. A single case report
D. A case control study

D. A case control study Starting from people with the outcome and looking back for exposure is efficient for rare events.

6. In a randomized trial, which step prevents investigators from steering certain patients into one group?

A. Concealing the allocation
B. Intention to treat analysis
C. Blinding outcome assessors
D. Using a sham procedure

A. Concealing the allocation Concealment hides the next assignment, preventing selection bias. Blinding protects against performance and detection bias.

7. Two examiners show a kappa of 0.35 for motion palpation of lumbar fixation. How is this agreement described?

A. Poor agreement
B. Moderate agreement
C. Fair agreement
D. Substantial agreement

C. Fair agreement Kappa 0.21 to 0.40 is fair, the usual range for interexaminer motion palpation.

8. A treatment lowers the rate of a bad outcome from 25% to 15%. What is the number needed to treat?

A. 7
B. 10
C. 4
D. 40

B. 10 ARR = 0.25 − 0.15 = 0.10, and NNT = 1 ÷ 0.10 = 10.

9. A trial reports a mean pain difference of 4 points on a 100 point scale with a 95% CI of −2 to 10. What is the correct reading?

A. Significant but too small
B. Significant and clinically important
C. Not statistically significant
D. Proves the two are equivalent

C. Not statistically significant The confidence interval for a difference crosses 0, so the result is not significant. It also does not prove equivalence.

10. For which condition does the evidence best support spinal manipulative therapy?

A. Childhood asthma
B. Chronic low back pain
C. Infantile colic
D. Essential hypertension

B. Chronic low back pain SMT has moderate certainty evidence for chronic low back pain, with effects similar to other recommended therapies. Evidence is absent or negative for the others.

CHAPTER 10

Subluxation Models, Basic Science Concepts and Applied Principles

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

What to know

The **medical subluxation** is a partial dislocation with joint surfaces still partly in contact, visible on imaging (atlantoaxial subluxation in RA, AC separation, nursemaid's elbow); a luxation is complete. Stephenson's 1927 chiropractic definition: loss of juxtaposition, less than a luxation, impinging nerves and interfering with transmission of mental impulses (misalignment, occlusion of an opening, pressure on nerves, interference). The modern **consensus definition** (1993, used by Medicare and WHO): a motion segment in which alignment, movement integrity and/or physiological function are altered although contact between the joint surfaces remains intact. The 1996 paradigm adds that it compromises neural integrity and may influence organ function and general health.

Medicare covers manual manipulation of the spine to correct a subluxation, shown by x-ray or by **PART**: pain and tenderness, asymmetry or misalignment, range of motion abnormality, tissue and tone changes. At least two of four, and one must be A or R. Only active or corrective care (AT modifier) is covered; maintenance needs advance notice if billed.

Related terms: fixation (motion palpation), joint dysfunction (Mennell, loss of joint play), joint blockage, osteopathic **somatic dysfunction** diagnosed by TART (tissue texture, asymmetry, restriction, tenderness), hypomobility and hypermobility (not the same as instability). The **vertebral subluxation complex** (Faye, expanded by Lantz) has five components: kinesiopathology, neuropathophysiology, myopathology, histopathology and biochemical abnormalities; Lantz added connective tissue, vascular and inflammatory components. Kirkaldy Willis described the degenerative cascade: dysfunction, instability, stabilization. There is no validated reference standard for detecting subluxation, and systemic effects are unproven.

Joint receptors (Wyke): **type I** superficial capsule, slowly adapting, static position; **type II** deep capsule, rapidly adapting, movement onset; **type III** ligaments, high threshold, extremes of motion; **type IV** free nerve endings, nonadapting, nociception. Gate control (Melzack and Wall, 1965): large fiber input closes the dorsal horn gate. **Korr** described the facilitated segment (a neurological lens), forerunner of central sensitization, and the trophic function of nerves. Dysafferentation (Seaman and Winterstein) is less mechanoreception and more nociception. Somatosomatic reflexes (pain, spasm, pain; multifidus inhibition) are the best supported model.

Nerve compression: **Sharpless** showed about 10 mm Hg on a dorsal root cuts conduction by up to half in 15 to 30 minutes; roots lack a full perineurium. Compression of a normal root gives a brief discharge, but the DRG or an inflamed root fires persistently; 5 to 10 mm Hg impairs venous return. **Crelin** found in cadavers that vertebral displacement alone could not close the IVF on the nerve. Compression is proven for disc and degenerative pathology, unproven for minor subluxation. **Sato** showed somatovisceral reflexes in anesthetized animals (segmental sympathetic and supraspinal vagal routes); clinical relevance in humans is not shown. Viscerosomatic referral is well established and a key red flag mechanism. Axoplasmic transport: fast 200 to 400 mm a day (kinesin), slow 0.2 to 5 mm a day, retrograde (dynein). Neuroimmune and vascular models remain hypotheses for minor subluxation.

The **motion segment** is two vertebrae with the disc, facets, ligaments and muscles: a three joint complex with six degrees of freedom. Axes: x side to side (flexion and extension), y vertical (axial rotation), z front to back (lateral bending). Panjabi's stabilizing system: passive, active and neural control; injury enlarges the neutral zone. Facets: occiput to C1 nodding about 25 degrees; **C1 to**

C2 rotation about 40 degrees each way, about half of cervical rotation; C2 to C7 at about 45 degrees; thoracic about 60 degrees favoring rotation; lumbar near sagittal favoring flexion and extension and resisting rotation. Fractures cluster at the thoracolumbar junction where facet orientation changes.

Coupled motion: lower cervical and upper thoracic lateral bending couples with rotation to the **same side** (bodies toward the concavity, spinous processes toward the convexity). Lumbar classically couples to the **opposite side** (bodies toward the convexity), a tendency rather than a law. Fryette: type I in neutral, opposite sides (group curves); type II in flexion or extension, same side (single segments); law III, motion in one plane reduces the others. In scoliosis the bodies rotate toward the convexity. The IAR lies near the posterior disc in a healthy lumbar segment and scatters with degeneration.

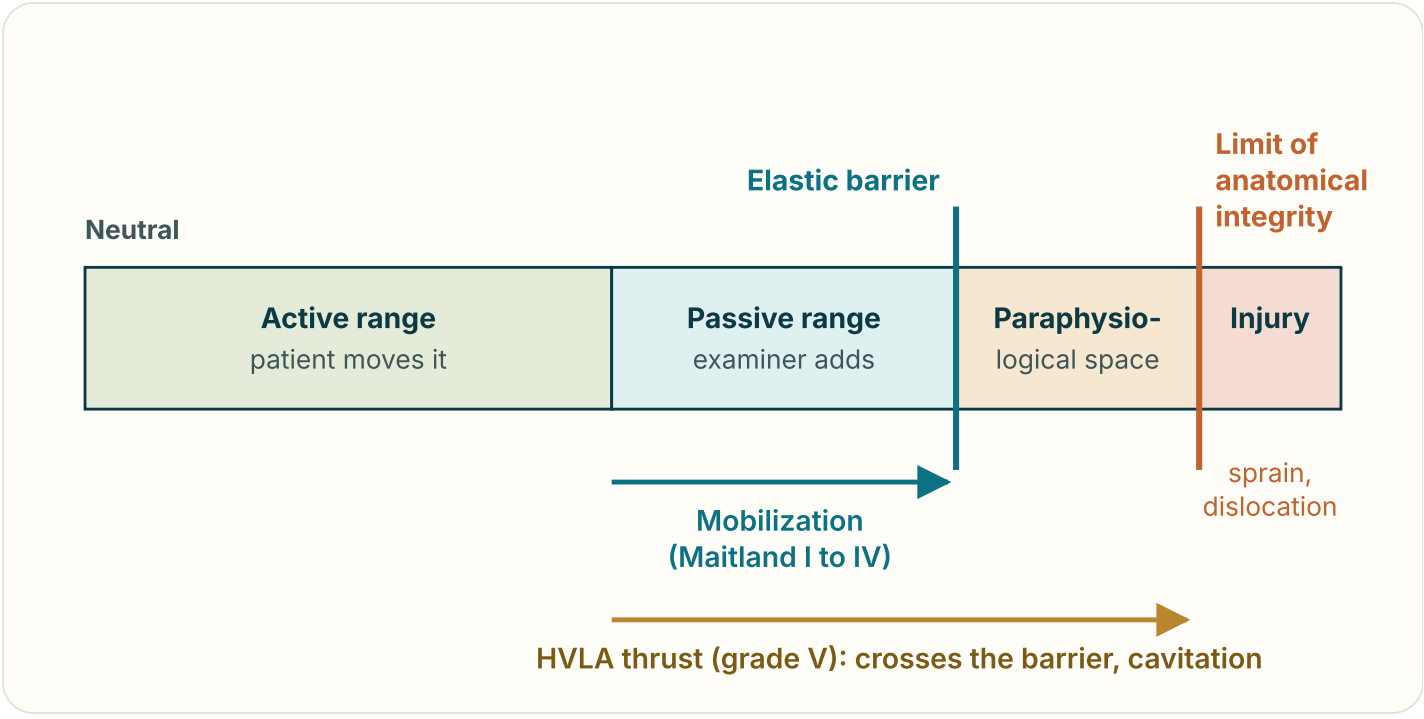
Disc: the nucleus is proteoglycan and type II collagen; annular fibers run about 30 degrees from horizontal in alternating layers; only the outer third is innervated. In standing the disc carries roughly 80% of compressive load. Classic L3 intradiscal pressures relative to standing (100%): supine 25%, side lying 75%, sitting 140%, standing flexed 150%, sitting flexed 185%. Discs imbibe overnight, so morning flexion loading is riskier. Tissues are **viscoelastic**: creep, stress relaxation, hysteresis, rate dependent stiffness. The ALL resists extension; the PLL, interspinous and supraspinous ligaments resist flexion; the ligamentum flavum is elastic and may buckle in stenosis.

Sandoz zones: active range, passive range ending at the elastic barrier, the paraphysiological space entered by an HVLA thrust with cavitation, and the limit of anatomical integrity. Maitland mobilization grades I to IV; grade V is manipulation. End feels: bony, capsular, soft tissue approximation are normal; spasm, springy block and **empty** (pain stops motion, serious pathology) are abnormal. Healing: inflammation 0 to about 72 hours, repair about 2 days to 6 weeks (type III collagen), remodeling about 3 weeks to 12 months or more (type I). Immobilization causes adhesions, cartilage loss, atrophy and bone loss, supporting early controlled motion.

The thrust: preload to the elastic barrier (about 20 to 150 N), a thrust of about **100 to 200 ms** (peak about 400 to 550 N thoracic and sacroiliac, 100 to 150 N cervical), then resolution.

Cavitation is gas, mostly CO_2, forming as joint pressure drops (tribonucleation); the refractory period is about **20 minutes**; it often occurs at other segments and does not predict outcome. Effects are mainly neurophysiological: afferent discharge, reflex EMG then reduced tone, H reflex depression, hypoalgesia locally and remotely, brief sympathoexcitation, plus contextual effects. No lasting change in vertebral position is shown.

Adverse events: benign reactions in about 30 to 60% of patients, within 24 hours and resolving in 24 to 48 hours. Cervical artery dissection associated with manipulation is rare (about 1 in 400,000 to 1 in several million), causation is not established, and patients should be informed. Screen the history for a dissection in progress. Phases of care: acute (expect change in about 2 weeks; after two trials without change, modify or refer), corrective, supportive, maintenance (helps selected patients with recurrent low back pain who responded, about 13 fewer bothersome days a year), wellness (unproven). Prevention levels: primary, secondary, tertiary, **quaternary** (avoiding overmedicalization). Adults need 150 to 300 minutes of moderate activity a week plus strength twice a week. Tobacco: the 5 As. Stages of change: precontemplation, contemplation, preparation, action, maintenance. Motivational interviewing uses OARS. Consent is PARQ: procedures, alternatives, risks, questions.



A thrust goes just past the elastic barrier and no farther. Mobilization stays within the passive range. A manipulation briefly enters the paraphysiological space, usually with cavitation, and must stop short of the limit of anatomical integrity.

LOCK THESE IN

- Medical subluxation is a partial dislocation; the consensus chiropractic subluxation keeps joint contact intact.
- PART: two of four, and one must be asymmetry or range of motion.
- VSC: kinesiopathology, neuropathophysiology, myopathology, histopathology, biochemical (Faye; Lantz added more).
- Sharpless about 10 mm Hg; Crelin cadavers; Korr facilitation; Sato animal somatovisceral reflexes.
- Cervical coupling same side; lumbar classically opposite; scoliosis bodies rotate to the convexity.
- Intradiscal pressure: supine 25, side lying 75, standing 100, sitting 140, standing flexed 150, sitting flexed 185.
- Paraphysiological space lies between the elastic barrier and the limit of anatomical integrity.
- Cavitation is gas with a 20 minute refractory period and does not predict outcome.

Neurological models and their evidence

Model	Mechanism	Status
Dysafferentation, somatosomatic	Less mechanoreception, more nociception; guarding	Best supported
Facilitation (Korr)	Sustained input lowers segmental thresholds	Physiology established; link to subluxation uncertain
Nerve compression (Sharpless)	Pressure on root or DRG	Proven for disc and stenosis; unproven for minor subluxation
Somatovisceral (Sato)	Somatic input alters organ function	Animal data; human relevance not shown
Viscerosomatic	Visceral input refers pain to the back	Well established; red flag
Axoplasmic aberration	Slowed axonal transport	Animal compression data only
Neuroimmunomodulation	Altered immune regulation	Small transient lab changes
Vascular insufficiency	Vasomotor or venous change	Theoretical except venous congestion in stenosis

Biomechanics numbers

Item	Value	Note
Occiput to C1	About 25 degrees flexion and extension	The "yes" joint
C1 to C2	About 40 degrees rotation each way	About half of cervical rotation
Facet angles	C 45°, T 60°, L about 90° to transverse plane	Rotation thoracic, flexion lumbar
Disc load in standing	About 80% or more	Facets carry more in extension
Annulus fibers	About 30° from horizontal, alternating	Half resist each rotation
Thrust	About 100 to 200 ms; preload 20 to 150 N	Peak 400 to 550 N thoracic
Cavitation refractory period	About 20 minutes	Gas redissolves
Inflammation / repair / remodeling	0 to 72 h / 2 days to 6 weeks / 3 weeks to 12 months+	Type III then type I collagen
Benign reactions	About 30 to 60% of patients	Resolve in 24 to 48 hours

Worked cases

WORKED CASE 1 · APPLYING PART FOR MEDICARE

A patient's chart documents pain and tenderness at L4 and tissue tone changes in the paraspinals. No asymmetry or range of motion abnormality is recorded and no x-ray was taken.

STEP 1 · COUNT THE CRITERIA

P (pain) and T (tissue and tone): two of four.

STEP 2 · APPLY THE RULE

One of the two must be A (asymmetry) or R (range of motion). Neither is documented.

STEP 3 · DECIDE

Subluxation is **not** demonstrated for Medicare. Document segmental asymmetry or a range of motion abnormality, or use x-ray.

COVERAGE REMINDER

Only active or corrective care with expected functional improvement (AT modifier) is covered; maintenance care is not.

WORKED CASE 2 · COUPLED MOTION AND SCOLIOSIS

A patient laterally bends to the right. Predict the coupled rotation in the lower cervical spine and in the lumbar spine, and the rotation in a right thoracic structural curve.

STEP 1 · LOWER CERVICAL

Lateral bending and rotation to the **same side**: bodies rotate right (toward the concavity) and spinous processes swing left (toward the convexity).

STEP 2 · LUMBAR, CLASSICALLY

Opposite sides: bodies rotate left (toward the convexity), spinous processes toward the concavity. This is a tendency, not a law.

STEP 3 · RIGHT THORACIC SCOLIOSIS

Bodies rotate toward the convexity (right), spinous processes toward the concavity, and the rib hump appears on the convex (right) side.

WORKED CASE 3 · RANKING DISC PRESSURE IN DAILY POSITIONS

A patient with an acute disc injury asks which positions load the disc least and most.

STEP 1 · USE STANDING AS 100%

Classic L3 values: supine 25%, side lying 75%, standing 100%, sitting upright 140%, standing flexed 150%, sitting flexed 185%.

STEP 2 · ADVISE

Lying down unloads the disc most; slumped flexed sitting loads it most. Lifting with a flexed spine is higher still.

STEP 3 · ADD TIMING

Discs imbibe fluid overnight, so avoid sustained flexion loading in the first hour after rising.

HONESTY NOTE

Later in vivo studies found relaxed sitting closer to standing, but the board teaches the classic order.

WORKED CASE 4 · MATCHING ADVICE TO STAGE OF CHANGE

A patient with chronic back pain says, "I know I should exercise, and I might start sometime, but not yet."

STEP 1 · NAME THE STAGE

Thinking about change without a plan is **contemplation**.

STEP 2 · CHOOSE THE APPROACH

Use motivational interviewing (OARS): open questions, affirmations, reflective listening, summaries, to draw out the patient's own reasons.

STEP 3 · BUILD SELF EFFICACY

Confidence predicts success. Offer a small, achievable first step toward 150 minutes of moderate activity a week.

STEP 4 · EXPECT RELAPSE

Relapse to an earlier stage is normal; plan for it rather than treat it as failure.

TRAPS PEOPLE FALL INTO

- **Equating the radiologist's subluxation with the chiropractic one.** A medical subluxation is a partial dislocation and may mean instability, not a lesion to adjust.
- **Accepting P and T for Medicare.** PART needs two of four and one must be A or R.
- **Claiming Sato proved subluxations cause organ disease.** He showed somatovisceral reflexes in anesthetized animals. Human clinical relevance is not shown.
- **Reversing cervical and lumbar coupling.** Cervical: same side. Lumbar: classically opposite side.
- **Treating cavitation as proof of a good adjustment.** Clinical outcome does not depend on hearing a pop.
- **Saying manipulation puts a bone back in place.** No lasting change in vertebral position is shown. The effects are mainly neurophysiological.
- **Calling hypermobility instability.** Hypermobility is increased motion. Clinical instability is failure of the stabilizing subsystems.
- **Billing Medicare for maintenance care without notice.** Maintenance is not medically necessary under Medicare and needs advance written notice.

Chapter 10 self-test · ten items

1. Which statement matches the consensus chiropractic definition of subluxation used by Medicare and WHO?

A. A complete loss of joint contact
B. A partial dislocation visible on x-ray
C. A bone out of place pinching a nerve
D. Altered function with joint contact intact

D. Altered function with joint contact intact The consensus definition describes a motion segment with altered alignment, motion or physiological function while contact remains intact.

2. A chart documents asymmetry at C5 and paraspinal tissue changes. Is subluxation demonstrated for Medicare without x-ray?

A. Yes, two criteria including asymmetry
B. No, three criteria are required
C. No, an x-ray is always required
D. No, pain must be one of the two

A. Yes, two criteria including asymmetry PART needs two of four with one being asymmetry or range of motion. A plus T qualifies.

3. Which component of Faye's vertebral subluxation complex refers to altered motion and position?

A. Neuropathophysiology
B. Myopathology
C. Kinesiopathology
D. Histopathology

C. Kinesiopathology Kinesiopathology is altered motion, including hypomobility, hypermobility and misalignment, the usual starting point of the model.

4. Which joint receptor is high threshold, nonadapting and signals nociception?

A. Type II conical corpuscles
B. Type IV free nerve endings
C. Type III Golgi like endings
D. Type I globular corpuscles

B. Type IV free nerve endings Type IV receptors are free nerve endings that signal nociception and are sensitized by inflammatory chemicals.

5. Which investigator showed that about 10 mm Hg on a dorsal root can reduce conduction by up to half?

A. Sharpless
B. Kirkaldy Willis
C. Panjabi
D. Crelin

A. Sharpless Sharpless (1975) showed the vulnerability of nerve roots to low pressure. Crelin studied cadaver foramina, Kirkaldy Willis the degenerative cascade and Panjabi the stabilizing system.

6. In the lower cervical spine, right lateral bending is coupled with which motion?

A. Pure flexion without rotation
B. Translation without any rotation
C. Rotation of the bodies to the right
D. Rotation of the bodies to the left

C. Rotation of the bodies to the right Cervical lateral bending and rotation couple to the same side, so the bodies turn right and the spinous processes swing left.

7. Classic intradiscal pressure data show which position loads the L3 disc most?

A. Standing fully upright
B. Sitting slumped forward
C. Side lying, knees bent
D. Lying flat on the back

B. Sitting slumped forward Relative to standing (100%), sitting flexed is about 185%, the highest of the classic positions; supine is about 25%.

8. In Sandoz's model, where does a high velocity, low amplitude thrust take the joint?

A. Within the active range only
B. Short of the elastic barrier
C. Beyond anatomical integrity
D. Into the paraphysiological space

D. Into the paraphysiological space The thrust passes the elastic barrier into the paraphysiological space, usually with cavitation, and stops short of the anatomical limit.

9. After a lumbar joint cavitates, about how long until it can cavitate again?

A. About 2 minutes
B. About 20 minutes
C. About 20 seconds
D. About 24 hours

B. About 20 minutes Cavitation forms a gas cavity that slowly redissolves; the refractory period is about 20 minutes.

10. Which statement about maintenance care is best supported?

A. It prevents disease in healthy people
B. Medicare covers it as corrective care
C. It helps some with recurrent low back pain
D. It needs no review of patient outcomes

C. It helps some with recurrent low back pain A Nordic trial showed fewer bothersome pain days in patients with recurrent low back pain who responded well. Wellness adjusting is unproven and Medicare does not cover maintenance.

ONE PAGE

Cram sheet

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

Names, dates and numbers

Item	Value	Note
First adjustment	September 18, 1895; Harvey Lillard	Davenport, Iowa; upper thoracic; deafness
Name	1896, Rev. Samuel Weed	Cheir plus praxis
Legal	Morikubo 1907; Wilk 1987	Philosophy defense; antitrust
Licensure	Kansas 1913 to Louisiana 1974	NBCE 1963; CCE 1974
Kappa	Fair 0.21 to 0.40; moderate 0.41 to 0.60	Substantial 0.61 to 0.80
MCID	NPRS 2 points or 30%; ODI 10; NDI 5 of 50	Compare effect with MCID
Stats	Alpha 0.05; power 0.80	CI crossing 0 or 1 is not significant
NNT	1 ÷ ARR	ARR = CER − EER
Sharpless	About 10 mm Hg cuts root conduction up to half	15 to 30 minutes
C1 to C2	About 40° rotation each way	Half of cervical rotation
Disc pressure	Supine 25, standing 100, sitting 140, sitting flexed 185	Classic L3 values
Thrust and cavitation	100 to 200 ms; refractory about 20 min	Pop does not predict outcome
Dissection risk	About 1 in 400,000 to several million	Causation not established

Rules that decide questions

Topic	The rule
Founder vs developer	D.D. founder (tone, Innate, three Ts); B.J. developer (x-ray, NCM, HIO, straight).
Paradigm	Includes diagnosis; portal of entry means diagnose and refer.
Limits of adaptation	Innate is limited by matter; supports referral.
Design	RCT therapy; cohort prognosis; case control rare harm; cross sectional diagnosis.
Bias	Concealment: selection. Blinding: performance and detection. ITT keeps randomization.
Reliability	Pain provocation better than motion palpation; reliable is not always valid.
Evidence	Modest short term benefit for LBP, neck pain, cervicogenic headache; none for visceral disease.
PART	Two of four, one must be A or R.
Coupling	Cervical same side; lumbar opposite; scoliosis bodies to the convexity.
Sandoz	Thrust into paraphysiological space, short of anatomical limit.
Care phases	Acute, corrective, supportive, maintenance, wellness; Medicare covers active only.

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