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Clinical Reasoning and Manipulation

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Aaron Hartstein, PT, DPT, OCS, FAAOMPT

Orthopaedic Manual Physical Therapy Series
Charlottesville 2017-2018

Precautions and Rules

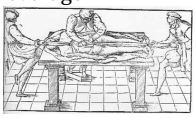
- Show care with all techniques
- Do NOT allow any assessment or treatment technique to be done to you if you are not entirely comfortable and confident with the setup, handling or technique
- Do NOT preform any techniques if you have any doubts about the technique or set up
- ALL of the required safety tests and examination techniques must be done on all the participants prior to having manipulative techniques performed
- Those who have (+) findings from safety tests or have other contra-indications are NOT to be manipulated
- Assessment of and vigilance for changing signs must be continuous and on-going throughout the assessment and treatment for every technique on every occasion
- All techniques must be preceded by information to the receiver on the type of technique to be performed, and a verbal agreement of consent and understanding should be obtained
- Participants are responsible to take precautions to protect any known sensitive areas of their spine

Goals of Today

- Exposure
- Awareness
- Clinical Relevance
- Practice, Practice, Practice

Who Owns Manipulation?

- No Ownership – Dates to Hippocrates, 460-355 B.C. who wrote 'On Setting Joints by Leverage'



- P.T. Practice – 1920's
- The Guide to Physical Therapist Practice outlines practice standards for physical therapists
  - Regarding manual therapy, this includes the entire continuum of mobilization/manipulation interventions including thrust techniques

Joint Manipulation Curricula in Physical Therapist Professional Degree Programs

2004

William Boissonnault, PT, DHSc, FAAOMPT[1]
Jean M. Bryan, MPT, PhD, OCS[2]
Kristin J. Fox, MPT, CSCS[3]

- **75%** programs included joint manipulation in curriculum
- Reasons manipulation is not taught:
  - **Not Entry-Level Skill = 45%**
  - **LACK OF TIME = 26%**
  - Lack of Qualified Faculty = 7%
  - Lack of Scientific Evidence = 7%

TABLE 2. Joint manipulation curriculum: percentage of joint manipulation curricular hours for each body region (total percent equaled 100% of curricular hours included for each program). The "programs not teaching column" represents the percentage of programs not including that body region in the curriculum.

Body Region	Percent of Curriculum (SD)	Range	Programs Not Teaching (%)
Cervical spine	8.9 (11.0)	0-40	46.9
Thoracic spine	25.4 (18.9)	0-100	6.1
Lumbar spine	25.1 (17.0)	0-80	14.3
Pelvis/sacral iliac	21.9 (19.8)	0-100	12.2
Upper extremity	8.3 (10.3)	0-40	42.9
Lower extremity	10.3 (16.5)	0-100	38.8

J. TIMOTHY NOTEBOOM, PT, PhD[1] • CHRISTIAN LITTLE, PT, DPT, OCS, FAAOMPT[1]
WILLIAM BOISSONNAULT, PT, DHSc[2]

Thrust Joint Manipulation Curricula in First-Professional Physical Therapy Education: 2012 Update

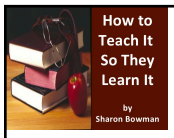
- 72% programs responded
- **99%** programs teaching TJM
- 97% of faculty believing TJM to be an entry-level skill
- Cervical spine TJM is still being taught at a lower rate than techniques for other body regions
- Faculty deemed 91% of students at entry level and 77% above entry level competency
- Avg teaching time spent = 10.5 hrs (lecture) and 21.1 hrs (lab)

TABLE 3 PERCENTAGE OF THRUST JOINT MANIPULATION CURRICULAR HOURS FOR EACH BODY REGION

Body Region	Percentage of Curriculum*	Programs Not Teaching TJM, %†
Cervical spine	9.9 ± 9.8	35
Thoracic spine	25.5 ± 10.7	3
Lumbar spine	28.1 ± 12.6	1
Pelvis/sacrum	15.6 ± 8.1	7
Upper extremity	8.7 ± 8.3	23
Lower extremity	12.2 ± 9.5	13

Barriers to TJM Curricular Implementation

Several barriers to implementing TJM into curricula were reported in 2004,[1] with the belief that TJM was not an entry-level skill and lack of time, qualified faculty, and evidence being the most frequently cited. In the current survey, respondents noted very few barriers to implementation. The one area of consistency between the 2 surveys was potential time constraints. Although 57% of our respondents stated that they had sufficient time to teach TJM, 97% of respondents stated that they would like more time to teach the content area.



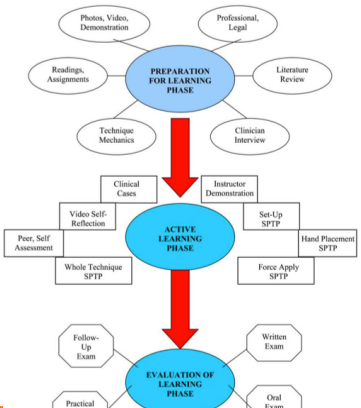
A model for teaching and learning spinal thrust manipulation and its effect on participant confidence in technique performance

Christopher H. Wise[1], Ronald J. Schenk[2], Jill Black Lattanzi[3]

Methods: A cohort of 15 DPT students in their final semester of entry-level professional training participated in an active training session emphasizing a sequential partial task practice (SPTP) strategy in which participants engaged in partial task practice over several repetitions with different partners. Participants' level of confidence in the performance of these techniques was determined through comparison of pre- and post-training session surveys and a post-session open-ended interview.
Results: The increase in scores across all items of the individual pre- and post-session surveys suggests that this model was effective in changing overall participant perception regarding the effectiveness and safety of these techniques and in increasing student confidence in their performance. Interviews revealed that participants greatly preferred the SPTP strategy, which enhanced their confidence in technique performance.

- Patient Group/Therapist Group
- Demonstration of Complete Task
- SPTP (Sequential **Partial Task Practice**) with Instructor
  - 1. Set-Up
  - 2. Hand Placement
  - 3. Force Application
- Perform 3-5x
- Complete Entire Technique Real-Time
- Perform 3-5x

Journal of Manual and Manipulative Therapy 2014 VOL. 0 NO. 0



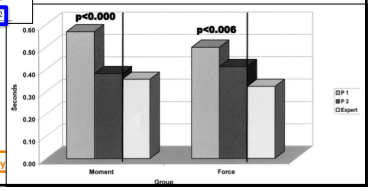
Procedural skills in spinal manipulation: do prerequisites matter?

John J. Triano, DC, PhD[a,b,*], Jacqueline Bougie, DC, MS[c], Carolyn Rogers, MS[a], John Scaringe, DC, MS[c], Kenneth Sorrels, DC[d], Dennis Skogsbergh, DC[a], Silvano Mior, DC[e]

Comparison of manipulation training prerequisite requirements

	Program 1			Program 2		
Academic area	Class hours	Lecture credit hours	Lab credit hours	Class hours	Lecture credit hours	Lab credit hours
Anatomy	555	19	18	510	14	20
Biochemistry	90	6	0	105	3	4
Chiropractic*	195[f]	10	9	269[f]	1	14
Clinic*	30	2	0	0	0	0
Diagnosis*	45	3	0	120	2	6
Microbiology	135	6	3	0	0	0
Nutrition	0	0	0	60	4	0
Pathology	105	5	2	0	0	0
Physiology	210	10	4	255	9	8
Principles and practice*	0	0	0	120	4	6
Radiology	0	0	0	90	2	4
Totals	1,425	61	36	1,529	39	62

There is no glory in practice, but without practice, there is no glory... –Unknown



What is the "Crack"?

- Results from phenomenon known as "joint cavitation"
  - Formation of vapor and gas bubbles within fluid
  - Local reduction in pressure
    - Some argue the "crack" may result from collapse of bubble
- Should not be an absolute requirement for achievement of mechanical effects but it may be necessary to achieve neurophysiological effects
  - Does not correlate with therapeutic effect
- After cavitation
  - Increase in size of joint space and gas may be found within space
    - "gas" has been described as 80% CO^2, or having density of nitrogen
  - Refractory period – gas bubble remains in space 15-30 mins

What Cracks in the Spine?

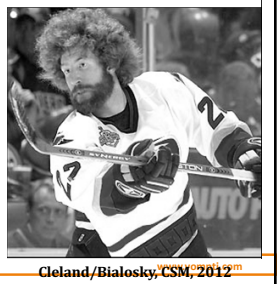
- Cavitation of Z-joint does occur with spinal TJM
  - Significantly larger joint space increase produced when cavitation occurs than without
    - Lumbar spine techniques, cavitation on "up" side more than "down"
- Tendency for multiple cavitations with spinal TJM
  - May occur on intended or contralateral side
- Location: on average, cavitation occurs within one segment above or below the target segment during various lumbar and thoracic techniques
- Clinicians are able to readily detect when cavitation has occurred

What do we tell patients?

How Spinal Manipulative Therapy Works: Why Ask Why? JOSPT 2008

JOEL E. BIALOSKY, PT, MS, OCS, FAAOMPT[1]
STEVEN Z. GEORGE, PT, PhD[2]
MARK D. BISHOP, PT, PhD, CSCS[3]

"When the scientific literature is considered, attributing successful spinal manipulative therapy outcomes solely to the identification and correction of biomechanical faults makes as much sense as crediting a beard for winning a hockey playoff series."



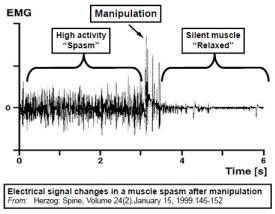
Cleland/Bialosky, CSM, 2012

Why Does Manipulation Work? One Theory

- Reflexogenic effect
- Resets signals
  - Between body and brain and spinal cord
- Allows muscle to reach optimal contraction
  - Breaks up spasm
  - Reduces inhibition

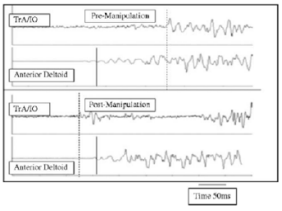
Neurophysiological Effects – Inhibitory vs. Excitatory

Inhibitory



Electrical signal changes in a muscle spasm after manipulation
From: Herzog: Spine, Volume 24(2),January 15, 1999.146-152

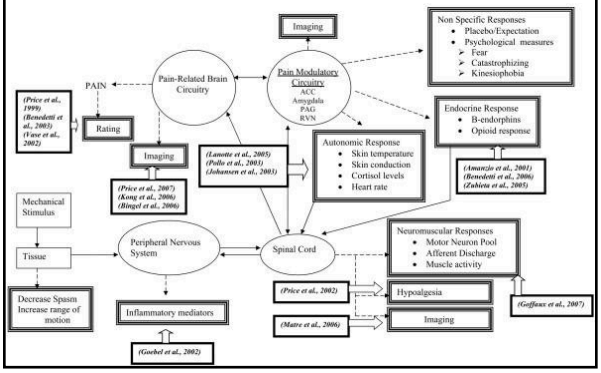
Excitatory



J Manipulative Physiol Ther 2006;29:196-202)

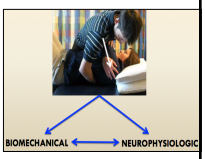
The mechanisms of manual therapy in the treatment of musculoskeletal pain: A comprehensive model

Joel E. Bialosky [a,*], Mark D. Bishop [a], Don D. Price [b], Michael E. Robinson [c], Steven Z. George [a]



Indications to Manipulate

- To facilitate Biomechanical effects
  - Increase movement
    - Mechanically locked/blocked spinal joint
    - Stiffness > pain
    - Oscillations may be too painful or plateaued
  - Release an entrapment (meniscoids/capsules)
- To facilitate Neurophysiological effects
  - To relieve pain
    - MIA – Manipulation Induced Analgesia
    - Non-opiod mechanism
    - Changes in pain pressure threshold
  - To increase circulation (sympathetic and parasympathetic effects)
  - To increase strength
    - Lower Trap
    - Abdominals
    - Deep Cervical Flexors
- To facilitate Psychological/Non-specific effect
- To differentially diagnose?
  - Stiff and painless C4/5 with adhesive capsulitis



Precautions for Manipulation

- **Neuromuscular**
  - Spinal Anomalies: scoliosis, spondylolisthesis, spina bifida, Arnold Chiari malformation, Scheuermann's disease, Klippel-Fiel, transitional or hemi-vertebrae
  - Stable fracture, hypermobility, instability, spasm end feel with palpation, stable neuro deficits, osteopenia (degree dependent)
  - Connective tissue disorders: Crohn's disease, inflammatory arthrites (RA)
- **Vascular**
  - Anatomical abnormalities of Vertebral Artery
  - Past history of DVT
  - Past history of Anti-Coagulant use
- **General Health**
  - Advanced or brittle Diabetes
  - Radiculopathy or Neurogenic pain

Contraindications to Manipulation

- **Neuromuscular**
  - Hx of Cancer (due to common Metastatic areas)
  - Bone diseases – osteoporosis, Paget's Disease, TB, Osteomyelitis
  - S/S of spinal cord involvement
  - S/S of Cauda Equina Syndrome
  - Neural S/S of > 1 adjacent cervical or 2 adjacent lumbar nerve roots (Neoplasm)
  - Others: severe pain, high irritability, acute radicular pain, unstable radicular pain, unstable compression fracture, increase in distal most symptoms early in range

Contraindications to Manipulation

- **Vascular**
  - S/S of VBI (for cervical techniques)
  - Blood clotting disorders (hemophilia, Von Willebrands, Factor V Leiden)
  - Current use of Anti-Coagulants
  - Hx of multiple DVTs of spontaneous nature
- **General Health**
  - Pregnancy after 3rd - 4th month and 6-12 weeks following delivery
  - Hx of oral corticosteroid use, 5mg or more for more than 3-6 months within the last 12 months
    - Risk of fracture increased rapidly after starting (3-6 months) but decreases after 1 year of stopping
  - Psychological pain or suspect non-musculoskeletal pain
  - Patient request not to be manipulated
  - Prolonged immobilization – leads to Ca+ loss
  - Bones exposed to high does of Radiation
  - Lack of clinical diagnosis or **patient consent**

Interpersonal Indications: Who to Manipulate??

- How do we determine who to manipulate?
- How do we "sell" this type of treatment to our patients?
  - What/How do we tell them?
- How do we fit this into management?
  - Minimize the **"event"**
- What does the ideal patient "look" like?
  - Subjectively
  - Objectively
  - Personality Traits?
  - EXPECTATIONS??

Research article **Open Access**

The influence of expectation on spinal manipulation induced hypoalgesia: An experimental study in normal subjects

Joel E Bialosky*[1], Mark D Bishop[1], Michael E Robinson[2], Josh A Barabas[1] and Steven Z George*[1] *BMC Musculoskeletal Disorders* 2008, **9**:19

- Significant increase in pain perception occurred in those who had negative expectation
- Potential influence of expectation on SMT induced hypoalgesia

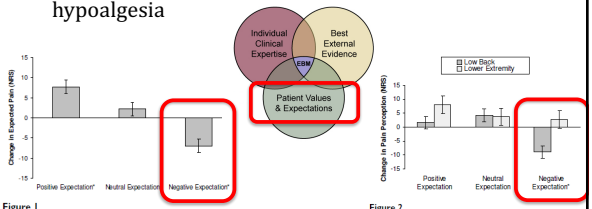


Figure 1
Effect of Instructional Set on Expected Pain in the Low Back. Change in expected pain in the low back follow-

Figure 2
Change in Pain Perception in the Low Back and Lower Extremity by Expectation Instructional Set.

What are the Risks? Can We Minimize Them?

Adverse Events With Manual Therapy

- Soreness
- Pain
- Stiffness
- Tiredness
- Weakness
- Paresthesia
- Gait disturbances
- Nausea
- Vertigo
- Vomiting
- Headache
- Visual disturbances
- Dysarthria
- Unconsciousness
- Dizziness
- TIA
- Cervical Artery Dissection (CAD)??

Adverse Events

- May occur with manual therapy WITH or WITHOUT spinal manipulation
- Typically occur within 24 hours and resolve within 72 hours
- Risk of major adverse event is lower than that from taking medication

Adverse Events – Manual Therapists Suffer Too!!!

Table 3: Type and number of Manual Medicine related injuries experienced by physicians.

Grades of Manual Medicine related injuries	Classification of Manual Medicine related injuries	Affected part of the body	Number
Major	None		
Moderate	Fracture	Of a carpal bone	(n = 1)
		Of a rib	(n = 2)
Mild	Joint dysfunction syndrome (physiological barrier limiting range of movement)	Spine, not specified	(n = 8)
		Sciatic pain	(n = 8)
		Thoracic spine	(n = 7)
		Lumbar spine	(n = 6)
		Cervical spine	(n = 1)
	Distortion	Finger, not specified	(n = 3)
		Thumb	(n = 3)
	Pain	Digitus index	(n = 1)
		Shoulder	(n = 3)
	Slap in the face		(n = 1)
Others		Inguinal hernia	(n = 1)
		Cervical spine degeneration	(n = 1)
		Carpal tunnel syndrome	(n = 1)

Risk of Cervical Manipulation

- Cervical Artery Dissection (CAD)
  - Tear or hematoma in the wall of the internal carotid (ICA) or vertebral artery (VA)
  - Most common reported major irreversible complication
    - 25% of ischemic strokes in people < 55 y.o
    - 2% of all ischemic strokes
  - Occurs most often subsequent to minor trauma but may occur SPONTANEOUSLY
  - More common between 35 and 50 years of age
    - Slightly more common in men
  - Some cases may be asymptomatic or cause minor symptoms
  - Usually involves intrinsic predisposition (genetics, anatomical)
  - Early presentation may mimic migraine or MSK disorder without clear neurological features
    - MUST ATTEMPT TO R/O DISSECTION IN PROGRESS

CAD vs. VBI symptoms

- CAD
  - Acute onset neck pain or headache
  - 30-50 y/o
  - History of recent trauma or infection
  - No clear link of signs and symptoms with head movement
  - Headache, neck pain
  - Moderate to severe pain
  - 5 Ds and other neurological symptoms (LE paresthesia, weakness, Horner's syndrome)
- VBI
  - Long standing neck pain or headache
  - > 65 y/o
  - No report of recent trauma or infection
  - Link of symptoms with head position or neck movement
  - Neck pain
  - Mild-moderate pain
  - 5 D's

Risk of Cervical Manipulation

- Place risk in perspective:
  - NSAIDs risks: 13.4 strokes/1000 people per year
  - GI toxicity: 1/1200 die each year from GI complications with NSAIDs > 2 months
  - Annual incidence of internal carotid dissection (ICAD) is estimated as 2.5-3 per 100,000 people (around 0.0025% of the population)
  - For vertebral artery dissection (VAD), 1-1.5 per 100,000 people or 0.001%
  - Estimates of CAD following cervical manipulation range at worst, from 1 in 100,000 (0.001%), to 1 in 6,000,000 manipulations
- True incidence difficult to determine (see haircut video)

Cervical Artery Dissection (CAD)

- Many possible proposed causes, most often a temporal relationship
- Linked to trivial trauma such as:
  - Golf swing
  - Trampoline use
  - Yoga
  - Sneezing
  - Massage Therapy
  - Roller coaster rides
  - Turkish barber visits

Mechanism of CAD and Stroke
Halderman, Spine, 1999

Mechanism	No. (%) of cases
Spontaneous	160 (43%)
Cervical Manipulation	**115 (31%)**
Trivial Trauma	58 (16%)
Major Trauma	37 (10%)
TOTAL	**367**

Effect of Selected Manual Therapy Interventions for Mechanical Neck Pain on Vertebral and Internal Carotid Arterial Blood Flow and Cerebral Inflow

Volume 93 Number 11 Physical Therapy

- Blood flow to the brain assessed in 8 different positions commonly used in treatment of mechanical neck pain
- None of the positions significantly decreased cerebral blood flow
- In healthy individuals without vascular disease or dysfunction, positions of the head and neck including end range of motion **does not** appear to impact cerebral blood flow

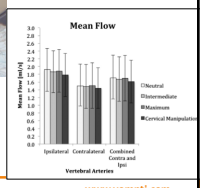
Changes in Vertebral Artery Blood Flow Following Various Head Positions and Cervical Spine Manipulation

WFC 2013 Award Winning Paper
ACCRAC 2013 Award Winning Paper

Journal of Manipulative and Physiological Therapeutics
January 2014

Jairus J. Quesnele, DC,[a] John J. Triano, DC, PhD,[b] Michael D. Noseworthy, PhD,[c] and Greg D. Wells, PhD[d]

- No significant difference changes in blood flow in the vertebral arteries of healthy young male adults after various head positions and cervical spine manipulations

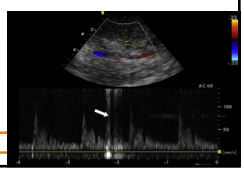


The immediate effect of atlanto-axial high velocity thrust techniques on blood flow in the vertebral artery: A randomized controlled trial*

Jonathan W. Erhardt [a,*], Brett A. Windsor [b], Roger Kerry [c], Chris Hoekstra [d], Douglas W. Powell [b], Ann Porter-Hoke [e], Alan Taylor [c]

Manual Therapy 20 (2015) 614–622

"The findings of this study indicate that in normal subjects, peak systolic and end diastolic blood flow velocities of the VA are not affected by HVT to the atlanto-axial joint. Therefore, in apparently healthy vessels, HVT to the atlanto-axial joint does not appear to increase mechanical stress on the VA. It remains unknown whether adverse haemodynamic responses would be recorded in the presence of vessel hypoplasia, vessel wall pathology or inherent weakness. Clinicians should retain an index of suspicion for potential vascular pathology as a presentation and conduct an appropriate risk assessment as suggested by IFOMPT (Rushton et al., 2012, 2013). Additional research should investigate latent changes in blood flow velocity as a slowly developing thrombus may not be immediately manifested through altered haemodynamics. Further, additional data suggesting a lack of effect of HVT techniques on blood flow can focus attention on alternative hypotheses such as a pathological predisposition to vessel injury.



Assessing the risk of stroke from neck manipulation: a systematic review

the results inconclusive. **Conclusion:** Conclusive evidence is lacking for a strong association between neck manipulation and stroke, but is also absent for no association. Future studies of association will need to minimise potential biases and confounders, and ideally have sufficient numbers of cases to allow subgroup analysis for different types of neck manipulation and neck movement.

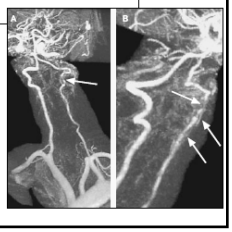
The Association Between Cervical Spine Manipulation and Carotid Artery Dissection: A Systematic Review of the Literature

Chadwick L.R. Chung, DC,[a] Pierre Côté, DC, PhD,[b,c,d] Paula Stern, DC,[e] and Georges L'Espérance, MD[f]

Conclusions: The incidence of ICA dissection after cervical spine manipulation is unknown. The relative risk of ICA dissection after cervical spine manipulation compared with other health care interventions for neck pain, back pain, or headache is also unknown. Although several case reports and case series raise the hypothesis of an association, we found no epidemiologic studies that validate this hypothesis. (J Manipulative Physiol Ther 2013;xx:1-5)

- "It has been suggested that the cervical manipulation in many cases may have been administered to patients who already had spontaneous dissection in progress…most cervical manipulations are administered to treat neck pain and headaches, these patients with a dissection in progress on seeing a practitioner are likely to be manipulated, and that in turn could precipitate a vascular occlusion or dislodge an embolus."

Haldeman et al, 1999



How Can We Minimize the Risk?

Value of VBI Testing

- No compelling evidence that clinical tests are useful to identify those at risk for VBI
- Negative findings do not rule out those at risk for VBI
- Haldeman 2002
  - Total of 64 cases of CVA associated with manipulation
  - VBI testing was performed and negative in 27 cases

TABLE 2 Diagnostic Utility of the Vertebrobasilar Insufficiency (VBI) Test*

Author	Sensitivity	Specificity	LR+	LR–
Cote et al 1996	0.00	0.86	0.00	1.16
Rivett et al 2000	0.10	0.39	0.16	2.30
Kerry et al 2003	0.31	0.48	0.59	1.44
Kerry 2006	0.10	0.44	0.16	2.30

** LR+ is the likelihood ratio for a positive test. LR– is the likelihood ratio for a negative test. The further away from 1 (on a scale of 0.001 to 1000) the LR is (LR+, above 1; LR–, below 1), the better the test at ruling the condition in or out. Above 10 would be considered a good LR+, and below 0.01 would be considered a good LR–. All readings from the studies in the table would indicate poor and inconsistent findings for the diagnostic utility of the VBI test.*

Fictional Assumption:

- Sn = 100% and Sp = 95% and Prevalence of 1:1000
- If test were (+) this only would lead to a Probability of 0.02%

Conventional VBI Testing

- Many procedures proposed to predict patients who may be at risk for injury, with much attention to vertebral artery
- Most recent literature suggests that pre-manipulative cervical artery testing is unable to identify those individuals at risk of vascular compromise

Review article

Diagnostic accuracy of premanipulative vertebrobasilar insufficiency tests: A systematic review☆,☆☆

Conclusion: Based on this systematic review of only 4 studies it was not possible to draw firm conclusions about the diagnostic accuracy of premanipulative tests. However, data on diagnostic accuracy indicate that the premanipulative tests do not seem valid in the premanipulative screening procedure. A surplus value for premanipulative tests seems unlikely.

OSTEOPRACTIC

PHYSICAL THERAPY

Pre-Manipulative Testing Prior to Cervical Manipulation: *Time to Abandon the **VBI** Test?*

OSTEOPRACTIC

PHYSICAL THERAPY

- Cervical HVLA thrust manipulation is "very unlikely to mechanically disrupt the vertebral artery"
- 1000 repeat strain cycles mimicking cervical HVLA manipulation did not cause histologically identifiable microdamage in arterial tissue
- Vertebral artery strains experienced during cervical HVLA manipulation were substantially less than the strain in the C1-C6 vertebral artery segments experienced during normal neck rotation or pre-manipulative VBI testing positions
- "Cervical spinal manipulative therapy performed by trained clinicians does not appear to place undue strain on the vertebral artery, and thus does not seem to be a factor in vertebrobasilar injuries"
- Blood supply to brain not compromised by C1/2 rotation, end range rotation, rotation + distraction
- Large RCT comparing HVLA vs Mobilization: "no serious neurovascular adverse events reported by any participant in either of the trials"
- Recent review (Murphy) concluded "current evidence indicates vertebral artery dissection syndrome is not a complication to cervical manipulation"
- Systematic review (Chung): no epidemiologic studies to support manipulation as being associated with increased risk of ICA dissection in patients with neck pain or headache
- Systematic review: no strong evidence linking occurrence of serious adverse events with use of cervical manipulation/mobilization in adults with neck pain

Cervical Arterial Dysfunction: Knowledge and Reasoning for Manual Physical Therapists

ROGER KERRY, MSc, MMACP, MCSP[1] • ALAN J. TAYLOR, MSc, MCSP[2]

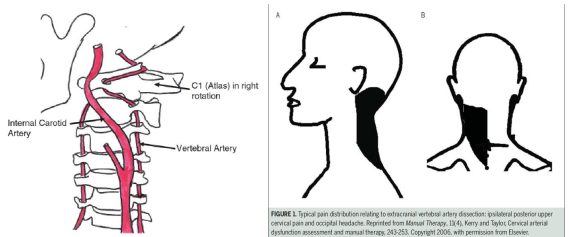


FIGURE 1. Typical pain distribution relating to extracranial vertebral artery dissection: ipsilateral posterior upper cervical pain and occipital headache. Reprinted from Manual Therapy, 11(4), Kerry and Taylor, Cervical arterial dysfunction assessment and manual therapy, 243-253. Copyright 2006, with permission from Elsevier.

JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY | VOLUME 39 | NUMBER 5 | MAY 2009

Risk factors and clinical features of craniocervical arterial dissection

Lucy C. Thomas[a,*], Darren A. Rivett[a], John R. Attia[b], Mark Parsons[c], Christopher Levi[c]

[a] Discipline of Physiotherapy, School of Health Sciences, Faculty of Health, The University of Newcastle, University Drive, Callaghan 2308, NSW, Australia
[b] General Medicine and Epidemiology, John Hunter Hospital, New Lambton Heights 2305, NSW, Australia
[c] Department of Neurology, John Hunter Hospital, New Lambton Heights 2305, NSW, Australia

Manual Therapy 16 (2011) 351–356

Reported symptoms in the dissection and control subjects (UL = upper limb, LL = lower limb) VBA = vertebrobasilar artery ICA = internal carotid artery.

Symptoms	VBAD $N = 27$	ICAD $N = 20$	Total dissection subjects $N = 47$	Control subjects $N = 43$
Headache	23 (85%)	15 (75%)	38 (81%)	22 (51%)
Neck pain	18 (67%)	9 (45%)	27 (57%)	6 (14%)
Dizziness	14 (52%)	1 (0.5%)	15 (32%)	3 (7%)
Visual disturbance	9 (33%)	7 (35%)	16 (34%)	12 (28%)
Paraesthesia (face)	8 (30%)	6 (30%)	14 (30%)	8 (19%)
Paraesthesia (UL)	9 (33%)	7 (35%)	16 (34%)	20 (47%)
Paraesthesia (LL)	4 (15%)	5 (25%)	9 (19%)	14 (33%)

Subjective History: 5 D's And 3 N's

Table 2
Clinical features of vertebral artery dissection and brainstem ischemia arising from vertebral artery insufficiency

Historical and clinical features suggestive of vertebral artery dissection
- Most common presenting symptoms are pain in the head and neck (in almost 90% of cases), often unilateral and sub-occipital
- Patient often never experienced a similar pain before
- Onset often acute, may be related to trauma or spontaneous. Distinction between traumatic and spontaneous quite arbitrary—spontaneous usually means no major trauma (RTA, fall). Detailed and careful history may reveal minor or trivial trauma (sports activities, painting the ceiling, sneezing).
  Searching for these things preceding the neck pain or headache may raise suspicion.
- Pain has distinct, but non-specific features, intensity often severe and quality sharp
- Patient may report a sensation of neck stiffness, but there is no limitation of ROM
- Time delay between onset of symptoms and clinical features of brainstem ischaemia can range from hours to up to 14 days

Clinical features suggestive of brainstem ischaemia arising from vertebral artery insufficiency
Major (most common) symptoms of vertebro-basilar insufficiency are:[a]
- Dizziness/vertigo/giddiness/light headedness
- Nausea (often with vomiting)
- Numbness—most often unilateral facial; less commonly may involve trunk and limbs (contraversive or ipsiversive)
- Ataxia/unsteadiness of gait is the most common
- Diplopia,
- (Patient may report limb weakness—uncommon feature)

Major (most common) neurological signs are:
- Ipsilateral Horners syndrome
- Ipsilateral limb ataxia
- Gait ataxia
- Ipsilateral sensory abnormalities of face (CN V); most commonly a loss of pain and temperature (dissociated sensory loss); can get diminished/absent ipsilateral corneal reflex
- Contraversive sensory abnormalities of trunk and limbs; most commonly dissociated (alternating analgesia)
- Ipsilateral cranial nerve IX–XII abnormalities
- Nystagmus; cerebellar or vestibular in origin
- Possible ipsilateral cranial nerve VII deficit
- Possible pyramidal signs; uncommon and often seen in isolation

Most clinical features arise from the territory of the posterior-inferior cerebellar artery (Wallenberg Syndrome)

Narrative Review

Safety of cervical spine manipulation: are adverse events preventable and are manipulations being performed appropriately? A review of 134 case reports

Emilio J. Puentedura[1], Jessica March[1], Joe Anders[1], Amber Perez[1], Merrill R. Landers[1], Harvey W. Wallmann[2], Joshua A. Cleland[3]

- CSM categorized as appropriate/inappropriate
- AE's categorized as preventable / unpreventable or unknown
- 60/134 (44.8%) categorized as preventable
- 14 categorized as unpreventable
- CSM performed appropriately in 80.6% cases
- Death resulted in 5.2% (7/134) cases (4 preventable)
- Conclusion: If all contraindications and red flags were ruled out, there was a potential for a clinician to prevent 44.8% of AE associated with CSM. 10.4% unpreventable suggests inherent risk associated with CSM even with thorough exam and clinical reasoning

Clinical Reasoning Contraindications/Red Flags

Table 1 Absolute contraindications to performing cervical spine manipulation (CSM)

Acute fracture	Acute soft tissue injury
Dislocation	Osteoporosis
Ligamentous rupture	Ankylosing spondylitis
Instability	Rheumatoid arthritis
Tumor	Vascular disease
Infection	Vertebral artery abnormalities
Acute myelopathy	Connective tissue disease
Recent surgery	Anticoagulant therapy

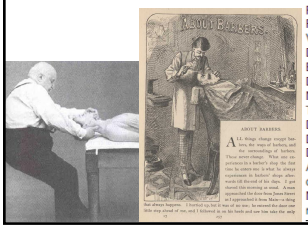
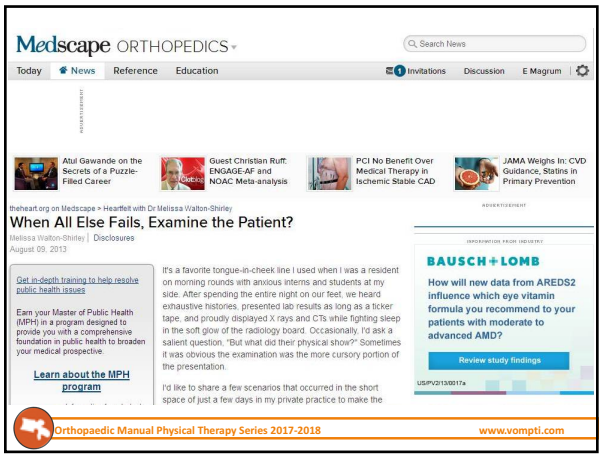


Table 2 Red flags

Previous diagnosis of vertebrobasilar insufficiency
Facial/intra-oral anesthesia or paresthesia
Visual disturbances
Dizziness/vertigo
Blurred vision
Diplopia
Nausea
Tinnitus
Drop attacks
Dysarthria
Dysphagia
Any symptom listed above aggravated by position or movement of the neck
No change or worsening of symptoms after multiple manipulations



Screening for Vertebrobasilar Insufficiency in Patients With Neck Pain: Manual Therapy Decision-Making in the Presence of Uncertainty

John D. Childs, PT, PhD, MBA, OCS, FAAOMPT[1]
Timothy W. Flynn, PT, PhD, OCS, FAAOMPT[2]
Julie M. Fritz, PT, PhD, ATC[3]
Sara R. Piva, PT, PhD, OCS, FAAOMPT[4]
Julie M. Whitman, PT, DSc, OCS, FAAOMPT[5]
Robert S. Wainner, PT, PhD, OCS, ECS, FAAOMPT[6]
Philip E. Greenman, DO, FAAO[7]

- Subjective History
- Trauma/mechanism
- Canadian C-Spine rules
- Assess Progressive loads to VA
- Mobilization versus Manipulation
- Avoid end ROM cervical rotation
- Thoracic mobilization versus cervical

Cervical arterial dysfunction and manual therapy: A critical literature review to inform professional practice

Roger Kerry[a,*], Alan J. Taylor[b], Jeanette Mitchell[c,d,e], Chris McCarthy[f]

VASCULAR ASSESSMENT??

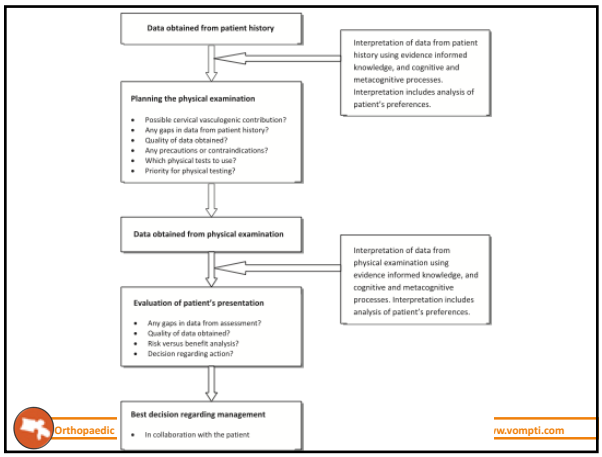
2. There is evidence supporting the relationship between vascular disease risk factors and CAD. As such the authors recommend a subjective assessment of vascular risk factors incorporating a 'system'-based approach (i.e. incorporating ICA and VA knowledge).

International framework for examination of the cervical region for potential of Cervical Arterial Dysfunction prior to Orthopaedic Manual Therapy intervention

Manual Therapy xxx (2013) 1–7

A. Rushton [a,*], D. Rivett [b], L. Carlesso [c], T. Flynn [d], W. Hing [e], R. Kerry [f]

- Framework approved by 22 member countries of IFOMPT (2012)
- Provide guidance to clinicians for assessment a intervention
- Highlights clinical reasoning process
  - Although rare (CAD), it is potentially serious and n to be considered in MS assessment
  - Manual therapists cannot rely on the results of one clinical tests to draw conclusions
  - Must have understanding of patients presentation, risk : benefit analysis, informed, planned and individualized assessment



Recommendations (Thomas et al.)

- For patients presenting with recent onset, moderate to severe unusual headache or neck pain
  - Clinicians should perform a careful history
    - Question about recent exposure to head/neck trauma or neck strain in the past 3-4 weeks
  - Be alert to reports of transient neurological dysfunction
    - Visual disturbance and balance deficits, arm paresthesia, and/or speech deficits within past 5 weeks
  - If suspect arterial dissection in progress patients should be urgently referred for medical evaluation

International framework for examination of the cervical region for potential of Cervical Arterial Dysfunction prior to Orthopaedic Manual Therapy intervention

A. Rushton [a,*], D. Rivett [b], L. Carlesso [c], T. Flynn [d], W. Hing [e], R. Kerry [f]

- Blood pressure testing
- Upper cervical ligamentous testing
- Neuro examination (including cranial nerve exam)
- Cervical artery/pre-thrust positional testing
- Carotid artery palpation
- Differentiate vascular signs/symptoms
- Clinical reasoning
- Risk/Benefit analysis
- Informed Consent

Decisions, decisions…

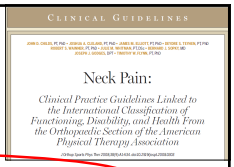
- Which technique to use?
  - Choose the technique that yields highest likelihood of achieving cavitation with the least force, in the most comfortable position possible
- Which side to treat?
  - May start with painful side (convention) but will see similar results with treatment of opposite side
  - May choose to thrust into restriction or in opposite direction
    - ROM may improve regardless of direction
  - May cavitate on either side, or both
    - Due to resonance cavitation may be felt on opposite side

Components of Successful Thrust

- Positioning: developing the appropriate tension
  - Use of spinal locking
    - Facet opposition
  - Develop a thrustable barrier
    - Sense of barrier, crisp with movement
- Patient and practitioner comfort and relaxation
- Final adjustments to fine tune barrier
  - Elements of compression/distraction, translation, AP or PA forces, flexion/extension
- Velocity/speed
  - Total thrust application time in cervical spine = 100ms

Drills To Develop Speed?

Literature Recommendations



- Interventions
  - Cervical mobilization/manipulation = A
  - Coordination, strengthening, endurance = A
  - Thoracic mobilization/manipulation = C
  - Stretching exercises = C
  - Centralization procedures and exercises = C

- A = Strong Evidence – Preponderance of Level I and/or Level II studies support the recommendation. Must include at least one Level I study
- C = Weak Evidence – A single Level II study or preponderance of Level III and IV studies including statements of consensus by context experts support the recommendation

Evidence Supporting Treating the Thoracic Spine for Neck Pain

- Short term improvements in pain and disability with thoracic thrust vs non-thrust mobilization/manipulation (Cleland, et al., 2007)
- Immediate changes in neck pain and AROM following T/S manipulation (Fernandez De-Las-Penas, 2007)
- RCT, Immediate effects of thoracic manipulation - increased cervical rotation and decreased pain at end range rotation (vs. control group of rest)(Krauss, et al., 2008)
- T/S manipulation demonstrated superior benefits (versus TENs/Heat) for acute neck pain at 2 weeks and 4 week follow-up (Gonzalez-Igelsias, et al., 2009)
- Short-term improvement in lower trapezius strength following T/S manipulation (Cleland, et al., 2002)

LITERATURE REVIEW

KEVIN M. CROSS, PT, PhD, ATC[1] • CHRIS KUENZE, MA, ATC[1] • TERRY GRINDSTAFF, PT, PhD[2] • JAY HERTEL, PhD, ATC[1]

Thoracic Spine Thrust Manipulation Improves Pain, Range of Motion, and Self-Reported Function in Patients With Mechanical Neck Pain: A Systematic Review

- Consistently reduced pain, improves ROM among patients with acute or sub-acute neck pain
- Treatment parameters not clear
- Immediate and Short-Term, Long-Term unclear
- Limited RCTs and limited generalizability

Regional interdependence and manual therapy directed at the thoracic spine

Journal of Manual and Manipulative Therapy 2015 VOL. 23 NO. 3

Amy McDevitt[1], Jodi Young[2], Paul Mintken[1], Josh Cleland[2]

[1]University of Colorado, School of Medicine, Physical Therapy Program, Anschutz Medical Campus, Aurora, CO, USA, [2]Franklin Pierce University, Physical Therapy Program, Concord, NH, USA

- "emerging evidence supporting neurophysiologic effect"
- "non-specific technique acting on pain modulating system, even though the exact mechanisms remain elusive"

making. Rather than using manual therapy to treat a localized biomechanical impairment, today's clinician, armed with current best evidence, may decide to treat a patient with shoulder pain using thoracic manipulation based on a well-documented neurophysiological effect, as opposed to a local biomechanical effect. This decision would be weighed more heavily towards current best evidence over examination findings from clinical tests and measures that are limited by questionable reliability and validity.[82,83] In addition, non-specific

Research Report

Physical Therapy Volume 93 Number 6

Immediate Effects of Region-Specific and Non–Region-Specific Spinal Manipulative Therapy in Patients With Chronic Low Back Pain: A Randomized Controlled Trial

Ronaldo Fernando de Oliveira, Richard Eloin Liebano, Luciola da Cunha Menezes Costa, Lívia Letícia Rissato, Leonardo Oliveira Pena Costa

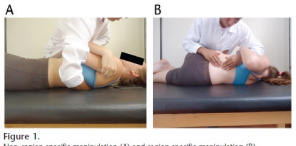


Figure 1.
Non–region-specific manipulation (A) and region-specific manipulation (B).

Conclusion. The immediate changes in pain intensity and pressure pain threshold after a single high-velocity manipulation do not differ by region-specific versus non–region-specific manipulation techniques in patients with chronic low back pain.

A randomized clinical trial to compare the immediate effects of seated thoracic manipulation and targeted supine thoracic manipulation on cervical spine flexion range of motion and pain

Steve Karas[1], Megan J. Olson Hunt[2]

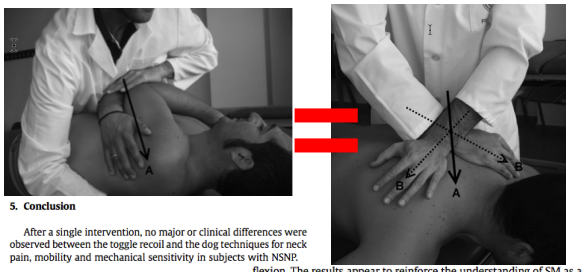
[1]Physical Therapy Program, Chatham University, Pittsburgh, PA, USA, [2]Department of Biostatistics, University of Pittsburgh, PA, USA

Results: Pain reduction (post-treatment–pre-treatment) was significantly greater in those patients receiving the targeted supine thoracic manipulation compared to the seated thoracic manipulation ($P<0.05$). Although not significant, we did observe greater improvement in flexion ROM in the targeted supine thoracic manipulation group. The results of this study indicate that a targeted supine thoracic manipulation may be more effective in reducing cervical spine pain and improving cervical flexion ROM than a seated thoracic manipulation. Future studies should include a variety of patients and physical therapists (PTs) to validate our findings.

Comparative short-term effects of two thoracic spinal manipulation techniques in subjects with chronic mechanical neck pain: A randomized controlled trial☆

Manual Therapy 19 (2014) 331–337

Amaloha Casanova-Méndez[a], Ángel Oliva-Pascual-Vaca[b], Cleofás Rodriguez-Blanco[b], Alberto Marcos Heredia-Rizo[b,*], Kristobal Gogorza-Arroitaonandia[a], Ginés Almazán-Campos[a]



5. Conclusion

After a single intervention, no major or clinical differences were observed between the toggle recoil and the dog techniques for neck pain, mobility and mechanical sensitivity in subjects with NSNP. flexion. The results appear to reinforce the understanding of SM as a non-specific technique acting on the pain modulating system, even though the mechanisms still remain elusive (Coronado et al., 2012).

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Thoracic Spine Biomechanical Dysfunctions – Referral Patterns

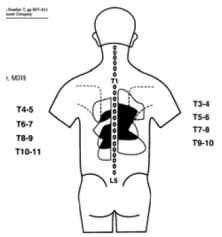
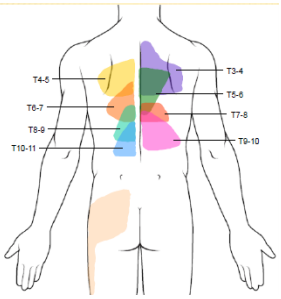


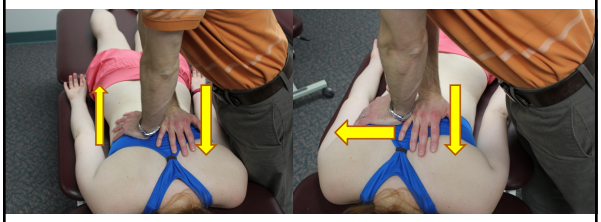
Figure 3. A composite map of the results in all volunteers showing referral patterns from the T3–T4 to T10–T11 thoracic zygapophyseal joints.



Thoracic Spine/Rib HVLA Techniques

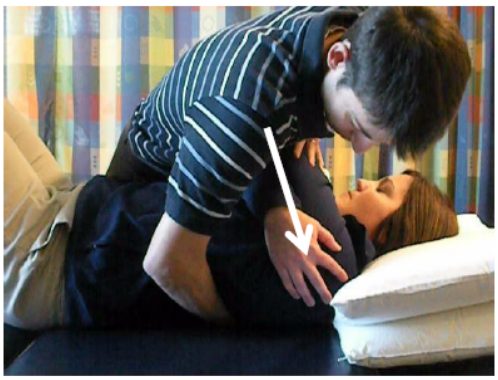
- Prone Rotary PA Facet and Costotransverse
- Supine AP/Dog
- Supine Rib
- Seated Mid Thoracic Distraction
- 1st Rib
- Seated CT Junction Distraction
- Prone CT Junction Lateral Flexion
- Techniques coupled with ND positions?

Prone Rotary PA HVLAT (Facet T2-9 vs. R2-9 Costotransverse)



Facet Costotransverse

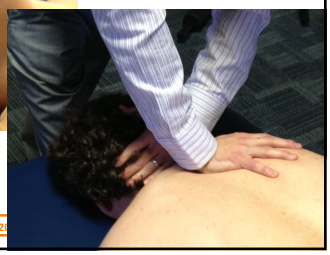
Supine Upper and Mid-Thoracic AP HVLAT



Supine Thoracic Spine Manipulation Modifications

- CT Junction
- TL Junction
- Hartman
  - Increase Specificity
    - Thoracic Rotation
    - Thoracic SB (ipsi)
    - Lumbar SB (contra)

Rib Manipulation



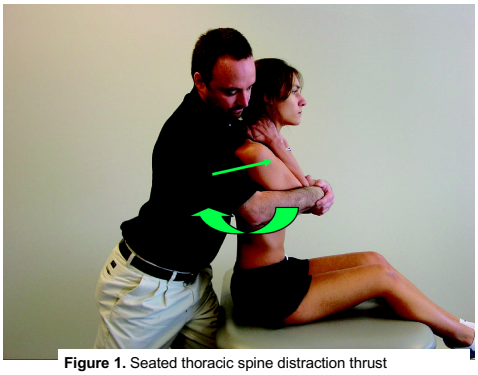
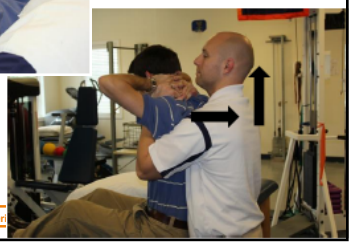


Figure 1. Seated thoracic spine distraction thrust manipulation used in this study. The therapist uses his or her sternum as a fulcrum on the subject's middle thoracic spine and applies a high-velocity distraction thrust in an upward direction.

1st Rib Manipulation: "Snooker" Technique

Orthopaedic Manual Physical Therapy Series

Seated CT Junction Distraction Manipulation



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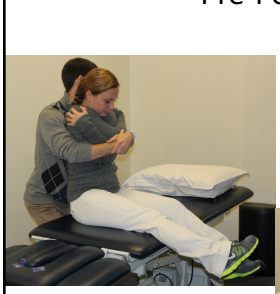
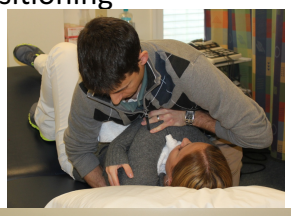
Prone CT Junction (C7-T3) Lateral Flexion HVLAT

Thoracic Manipulation with Neurodynamic Pre-Positioning





CLINICAL PRACTICE GUIDELINES

PETER R. BLANPIED, PT, PhD • ANITA R. GROSS, PT, MSc • JAMES M. ELLIOTT, PT, PhD • LAURIE LEE DEVANEY, PT, MSc
DEREK CLEWLEY, DPT • DAVID M. WALTON, PT, PhD • CHERYL SPARKS, PT, PhD • ERIC K. ROBERTSON, PT, DPT

Neck Pain: Revision 2017

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Orthopaedic Section of the American Physical Therapy Association

J Orthop Sports Phys Ther. 2017;47(7):A1-A83. doi:10.2519/jospt.20170302

Acute

For patients with **acute** neck pain with mobility deficits:

B Clinicians should provide thoracic manipulation, a program of neck ROM exercises, and scapulothoracic and upper extremity strengthening to enhance program adherence.

C Clinicians may provide cervical manipulation and/or mobilization.

Subacute

For patients with **subacute** neck pain with mobility deficits:

B Clinicians should provide neck and shoulder girdle endurance exercises.

C Clinicians may provide thoracic manipulation and cervical manipulation and/or mobilization.

Chronic

For patients with **chronic** neck pain with mobility deficits:

B Clinicians should provide a multimodal approach of the following:

- Thoracic manipulation and cervical manipulation or mobilization
- Mixed exercise for cervical/scapulothoracic regions: neuromuscular exercise (eg, coordination, proprioception, and postural training), stretching, strengthening, endurance training, aerobic conditioning, and cognitive affective elements
- Dry needling, laser, or intermittent mechanical/manual traction

C Clinicians may provide neck, shoulder girdle, and trunk endurance exercise approaches and patient education and counseling strategies that promote an active lifestyle and address cognitive and affective factors.

2008 CPG Recommendations

- Interventions
  - Cervical mobilization/manipulation = A
  - Coordination, strengthening, endurance = A
  - Thoracic mobilization/manipulation = C
  - Stretching exercises = C
  - Centralization procedures and exercises = C

- A = Strong Evidence – Preponderance of Level I and/or Level II studies support the recommendation. Must include at least one Level I study
- C = Weak Evidence – A single Level II study or preponderance of Level III and IV studies including statements of consensus by context experts support the recommendation

Masterclass

Articular dysfunction patterns in patients with mechanical neck pain: A clinical algorithm to guide specific mobilization and manipulation techniques

Manual Therapy xxx (2013) 1–8

Vincent Dewitte*, Axel Beernaert, Bart Vanthillo, Tom Barbe, Lieven Danneels, Barbara Cagnie [1]

Ghent University, Department of Rehabilitation Sciences and Physiotherapy, De Pintelaan 185 3B3, 9000 Ghent, Belgium

- Clinical reasoning algorithm
- Highlights key subjective and objective examination features to identify patients likely to benefit from cervical mob/manip
- Attempts to define optimal techniques pending on the individual presentation of the patient
  - As opposed to "move it and move on"
- Proposed model of manipulative progression based on SINSS

Which Necks to Manipulate?

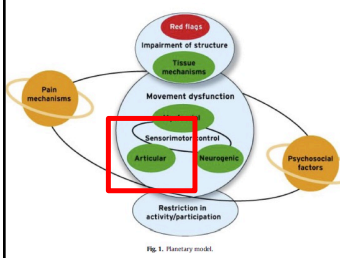


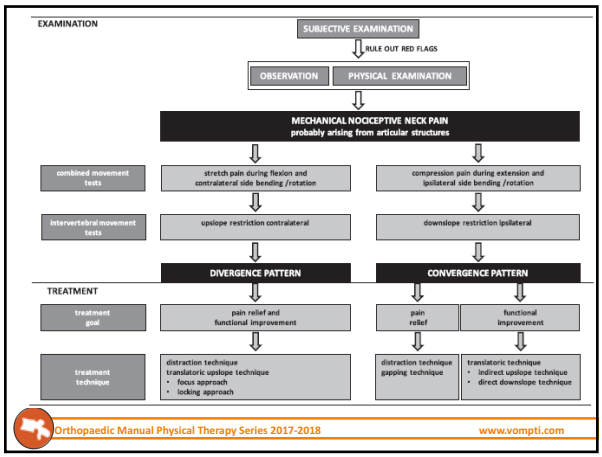
Fig. 1. Planetary model.

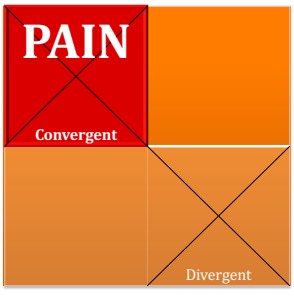
Based on clinical experience and available evidence in the literature, the type of clinical presentation that would suggest an amenity to manipulative therapy may include (McCarthy, 2001; Hing et al., 2003; Childs et al., 2008; Gellhorn, 2011; Dunning et al., 2012; Puentedura et al., 2012):

- primary complaint of neck pain (defined as pain in the region between the superior nuchal line and first thoracic spinous process);
- a problem that is mechanical in nature and fits with a biomechanical pattern that is regular and recognizable;
- a non-traumatic history of onset suggestive of mechanical dysfunction;
- a limited symptom duration (according to Puentedura et al. (2012) less than 38 days);
- limited range of motion (ROM) (direction specific), with a side-to-side difference in cervical rotation ROM of at least 10°;
- pain that has clear mechanical aggravating and easing positions or movements;
- local provocation tests produce recognizable symptoms;
- spinal movement patterns that, when examined actively and passively, suggest a movement restriction that is local to one or two functional spinal units;
- no neurological findings in clinical history or manual assessment;
- no signs of central hyperexcitability;
- no indication that referral to other health care providers is necessary (to exclude red flags);
- a positive expectation that manipulation will help.

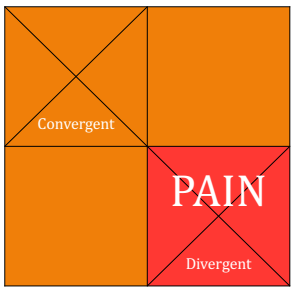
Articular Patterns of Mechanical Neck Pain

Cervical spine convergence pattern	Cervical spine divergence pattern
Subjective examination Feeling of locking Movement restriction Unilateral compression pain Often in acute cases Antalgic posture	*Subjective examination* Feeling of painful strain at end ROM Movement restriction at end ROM Unilateral stretch pain High intensity or severity of symptoms is rare Antalgic posture is uncommon
Physical examination Active and passive combined extension, ipsilateral side bending, and rotation is limited and evokes comparable signs	*Physical examination* Active and passive combined flexion, contralateral side bending, and rotation is limited and evokes comparable signs Passive shoulder elevation in this position does not result in increased ROM/decreased pain
Articular examination Provocation tests (spring testing) are positive at the impaired segment(s) Intervertebral Movement Tests: ipsilateral downslope restriction Segmental distraction alleviates the pain	*Articular examination* Provocation tests are positive at the impaired segment(s) Intervertebral Movement Tests: ipsilateral upslope restriction





- Convergent
  (+) R Ext Q
  - Distraction
  - Indirect Upslope
  - Direct Downslope



- Divergent
  (+) L Flex Q
  - Distraction
  - Direct Upslope

[RESEARCH REPORT]

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Development of a Clinical Prediction Rule to Identify Patients With Neck Pain Likely to Benefit From Thrust Joint Manipulation to the Cervical Spine

- 4 attributes to identify responders to TJM
  - Symptom duration less than 38 days
  - Positive **expectation** that manipulation will help
  - Side-to-side difference in cervical ROM 10° or more
  - Pain with PA spring testing of middle cervical spine
- 3 of 4 attributes present = +LR 13.5
- Probability of successful outcome increases from 39% to 90%

FIGURE 1. Cervical spine thrust manipulation used in this study. The therapist used his manipulative hand to localize the motion segment targeted and used both hands to perform a high-velocity, low-amplitude thrust into rotation, which was directed up toward the patient's contralateral eye (**ONLINE VIDEO**).

TREATMENT EXPECTATIONS

Indicate by circling the comment next to the treatment that corresponds to your amount of agreement with the following statement. Substitute each treatment into the blank as you consider your response.

I believe _____ will significantly help to improve **this episode** of my neck pain.

Note: If you have never received a particular treatment, base your answer on how much you think it would help if you were to receive this treatment. Ask your physical therapist about any treatment that is not familiar to you.

Medication	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
Rest	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
Surgery	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
Modalities (ie, heat packs, ultrasound, TENS, etc)	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
Massage	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
Manipulation (ie, having your neck or back "cracked" or "popped")	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
Traction (lying on your back or stomach with straps with a harness strapped on that stretches out your neck or back)	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
Aerobic exercise (ie, walking, stationary cycling, StairMaster, etc)	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
Range-of-motion exercises (ie, stretching)	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
Strengthening exercises	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree

Cervical Upglide/Upslope

Mid Cervical Upglide (Cradle Hold)

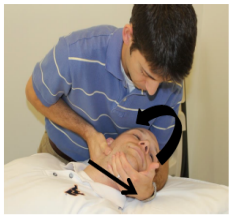
Contact Points: Radial border of proximal or middle phalanx of index finger contacts the posterolateral aspect of the articular pillar of the target segment (if C3/4 is target segment, contact is made to pillar of C3). Other hand contacts posterior arch of targeted segment on the opposite side. Remainder of hand supports occiput. Underneath hand very important to control force and maintain barrier.

Patient Positioning: Supine with head resting on pillow, towards side of bed to be manipulated.

Therapist Positioning: Diagonal stance at head of table but moves to side of technique.

Direction of Thrust: Primary lever is rotation (away) but barrier "built" with side-shift (away), side-bending (towards), flex/ext (as needed), PA (as needed), etc. Thrust is pronation/supination with both hands in direction of the patient's underside eye.

Lateral Thrust (Distraction)



Contact Points: Radial border of proximal or middle phalanx of index finger contacts the posterolateral aspect of the articular pillar of the target segment. Other hand cradles chin and side of head/face with volar forearm.

Patient Positioning: Supine head on pillow, to side of plinth to be manipulated

Therapist Positioning: Head end of table, to the side to be treated

Direction of Thrust: Primary lever of technique is side-bending but barrier can be assessed with rotation. Rotate away to place applicator hand, side-shift C2 away and side-bend at C2/3 towards, add fine-tuning levers of PA, flexion/extension (usually more extension). Thrust into translation in the direction of the opposite side.

Cervical Downglide/Downslope

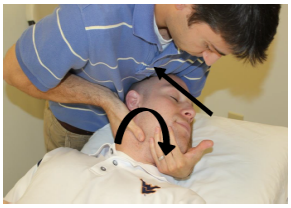
Contact Points: Radial border of proximal or middle phalanx of index finger contacts the most lateral portion of posterolateral aspect of the articular pillar of the target segment, near the transverse process. Other hand along posterior aspect of the head controlling posterior arch of target segment as well as the occiput.

Patient Positioning: Supine with head resting on pillow, towards side of bed to be manipulated.

Therapist Positioning: Head end of plinth, slightly to side of table to be treated

Direction of Thrust: Primary lever is side-bending towards, secondary lever of rotation away. Thrust can be delivered one of two ways depending on the lever of choice. Thrust into side-bending towards patients opposite hip (to extend the ipsilateral side), or thrust into rotation from side-bent position towards patients opposite shoulder in attempt to gap the opposite side facet.

Mid-Lower Cervical Rotary HVLA



Contact Points: Radial border of proximal or middle phalanx of index finger contacts the posterolateral aspect of the articular pillar of the target segment. Other hand cradles chin and side of head with volar forearm.

Patient Positioning: Supine with head resting on pillow, towards side of bed to be manipulated.

Therapist Postioning: Head end of plinth, moved to side of table to be treated

Direction of Thrust: Rotate away for convenience; isolate level with side-bending towards. Direction of thrust is rotation away while maintaining side-bending lever.

An Investigation Into the Kinematics of 2 Cervical Manipulation Techniques

Jonathan M. Williams, PhD,[a] and Antonio I. Cuesta-Vargas, PhD[b]

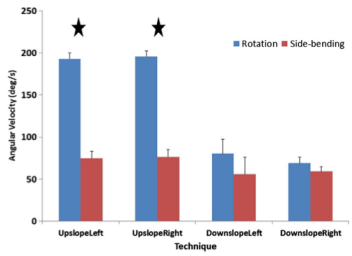
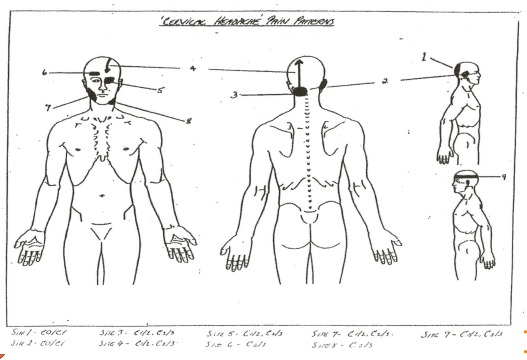


Fig 2. *Thrust velocity for each technique (P < .01). (Color version of figure is available online.)*

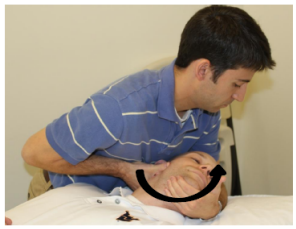
Upper Cervical Referral Patterns



Upper Cervical Treatment – OA Joint



OA Joint Distraction (Chin Hold)



Contact Points: Radial border of proximal phalanx of index finger contacts posterior-lateral occiput (medial and posterior to mastoid process). Head/face are cradled with forearm and chest with chin hold.

Patient Positioning: Supine head on pillow, towards side of plinth to be manipulated

Therapist Positioning: In direction of movement, slightly perpendicular to patient and feet angled towards patient's underside eye.

Direction of Thrust: Primary lever is contralateral rotation in a curved plane towards the underside eye. To create a mechanical barrier, additional levers of ipsilateral side-bend, side-shift away, extension, compression, PA, etc., are added as needed. Thrust is described as a "scoop into rotation" medially, inferiorly and anteriorly with both hands in a curved plane to match the shape of the OA joint. Repeat the scooping motion 2-3 times and at the top of the scoop, add small impulse into rotation.

RESEARCH ARTICLE Open Access

Dunning et al. BMC Musculoskeletal Disorders 2013, 14:24

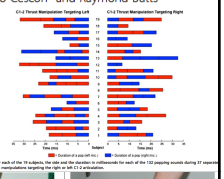
Bilateral and multiple cavitation sounds during upper cervical thrust manipulation

James Dunning[1,2*], Firas Mourad[3], Marco Barbero[4], Diego Leoni[4], Corrado Cescon[4] and Raymond Butts[5]

Conclusion

Cavitation was significantly more likely to occur bilaterally than unilaterally during upper cervical HVLA thrust manipulation; that is, the popping sounds associated with C1-2 manipulation were 11 times more likely to occur bilaterally than just unilaterally. Most subjects produced 3–4 pops during a single rotatory HVLA thrust manipulation targeting the right or left C1-2 articulation; therefore, practitioners of spinal manipulative therapy should expect multiple popping sounds when performing upper cervical thrust manipulation to the atlanto-axial joint. Furthermore, the traditional manual therapy approach of targeting a single ipsilateral or contralateral facet joint in the upper cervical spine may not be realistic.

Whether the multiple popping sounds found in this study emanated from the same joint, adjacent ipsilateral or contralateral facet or uncovertebral joints, or even extra-articular soft-tissues remains to be elucidated.



Articular dysfunction patterns in patients with mechanical low back pain: A clinical algorithm to guide specific mobilization and manipulation techniques

Manual Therapy xxx (2014) 1–4

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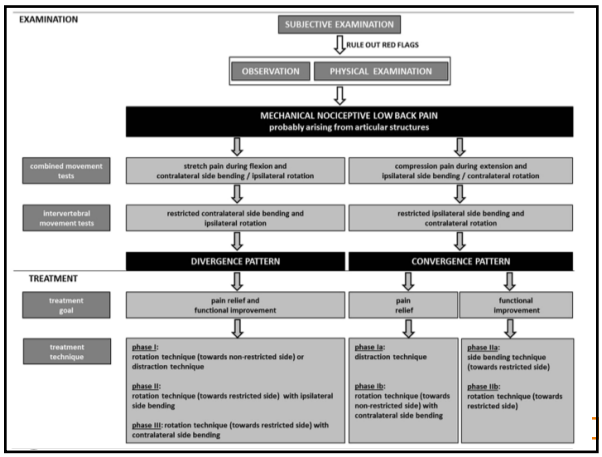
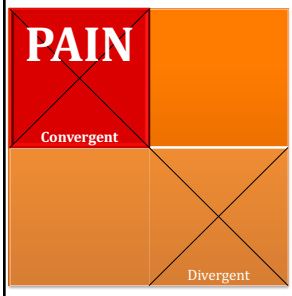
Based on clinical experience 3 key points will determine the type of articular dysfunction pattern:

1) *Provocation of symptoms during passive combined movement testing*: Specific combinations of combined movements can reproduce the patient's symptoms. The components of the combined movement during which the patient's symptoms are provoked, will determine the type of articular dysfunction pattern. The primary components are extension and flexion respectively combined with side bending whereas rotation is the additional component to make the symptoms more provocative. Reduced range of movement (ROM) is also often detected.
2) *Type of mechanical pain*: This may be categorized as compression pain originating from intra-articular derangements or stretch pain originating from capsulo-ligamentous structures.
3) *Restricted intervertebral movement tests*: Intervertebral movement tests may give additional information on the quality and quantity of the segmental joint play, as reduced intervertebral movement is very often associated with both articular dysfunction patterns.

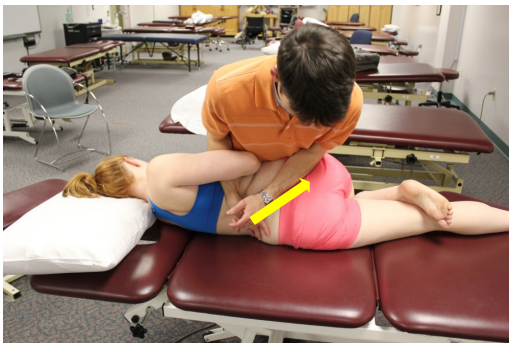
Table 1
Features of mono-segmental lumbar spine articular patterns.

	Lumbar spine	
	Convergence pattern	Divergence pattern
Subjective examination		
feeling of locking	yes	no
movement restriction	yes	yes at end of ROM
painful strain	sometimes (contralateral)	yes (ipsilateral)
compression pain	yes (ipsilateral)	no
antalgic posture	in acute cases	uncommon
Physical examination		
Active and passive combined movement tests	limited and evoke comparable signs	limited and evoke comparable signs
Primary component	extension	flexion
side bending	ipsilateral	contralateral
rotation	contralateral	ipsilateral
Articular examination		
Provocation (spring) tests	positive at the impaired segments	positive at the impaired segments
Intervertebral movement tests		
side bending reduced	ipsilateral	contralateral
rotation reduced	contralateral	ipsilateral



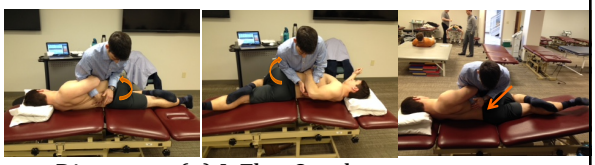


- Convergent
  (+) R Ext Q
  - Distraction
  - Rotation with L SB (Flex)
  - Rotation with R SB (Neu)
  - R SB in Extension
- Divergent
  (+) L Flex Q
  - Distraction
  - R Rotation (Neutral)
  - Rotation with R SB (Flex)
  - Rotation with L SB (Flex)



Mobilization/Manipulation Progression

- Convergent: (+) R Ext Quadrant



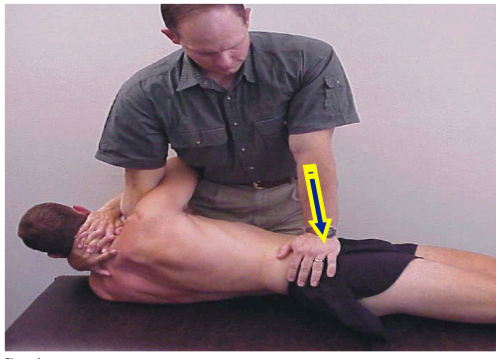
- Divergent: (+) L Flex Quadrant

ARTICLE

A Clinical Prediction Rule To Identify Patients with Low Back Pain Most Likely To Benefit from Spinal Manipulation: A Validation Study

Maj John D. Childs, PhD, PT; Julie M. Fritz, PhD, PT; Timothy W. Flynn, PhD, PT; James J. Irrgang, PhD, PT; Maj Kevin K. Johnson, PT; Maj Guy R. Majkowski, PT; and Anthony Delitto, PhD, PT

- Predictor Variables
  - Pain does not travel below the knee
  - Onset ≤ 16 days ago
  - Lumbar hypomobility
  - Either hip has > 35° of internal rotation
  - FABQ Work score < 19
- 4 or more variables
  - +LR 24.4



Lumbopelvic Manipulation

Lumbopelvic / SIJ Regional Manipulation