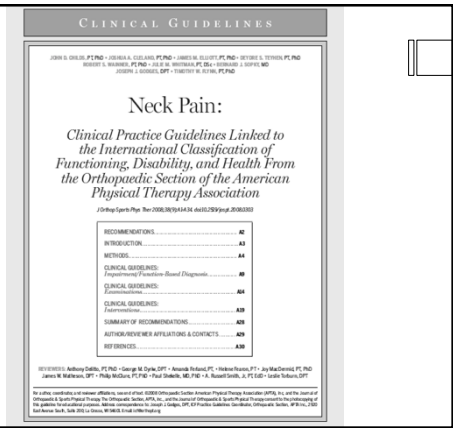
Integrating Movement System Impairments and Manual Therapy in assessment and treatment of the cervical spine

Kenneth A. Olson, PT, DHSc, OCS, FAAOMPT

Michael Wong, PT, DPT, OCS, FAAOMPT


CLINICAL GUIDELINES

Neck Pain:

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

Neck Pain ICF Impairment-based Classification:

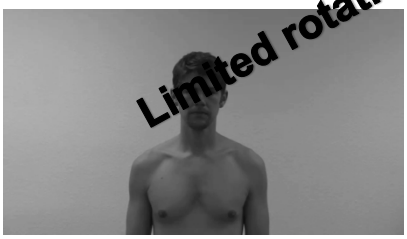
- Neck pain with mobility deficits
- Neck pain with headaches
- Neck pain with radiating pain
- Neck pain with movement coordination impairments

J Orthop Sports Phys Ther. 2008;38 (September): A1-A39

Neck pain with mobility deficits

- ICD Diagnosis
  - Cervicalgia
  - Pain in thoracic spine

- Isolated neck pain
- Restricted cervical range of motion
- Pain provocation and mobility deficits with palpation of cervical/thoracic joints

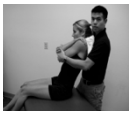


Neck pain with mobility deficits

Interventions

- Cervical mobilization/manipulation
- Thoracic mobilization/manipulation
- Stretching exercises
- Coordination, strengthening, and endurance exercises





Neck pain with headache

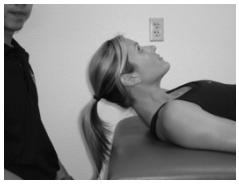
- ICD Diagnoses:
  - Headaches
  - Cervicocranial syndrome

Key findings

- Headache reproduced with provocation of the involved upper cervical segments
- Restricted upper cervical segmental mobility

Key findings

- Abnormal/substandard performance on the cranial cervical flexion test



Restrict cervical range of motion

Limited rotation!

Key findings

1. Patient is supine.
2. Examiner is at head of patient.
3. Resting symptoms are assessed.
4. Patient actively flexes neck to maximum range.
5. Examiner applies full rotational force to both sides.
6. Symptoms are reassessed during each motion.
7. (+) test with pain provocation **and/or**
8. (+) test if loss of 10° or greater.

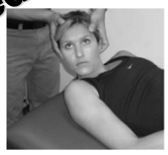


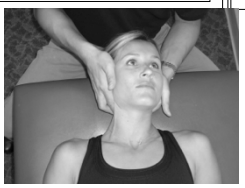
FIGURE 6-16 Flexion-Rotation Test

Reliability	Sensitivity	Specificity	(+) LR	(–) LR
NT	86	100	NA	NA

Neck pain with headache

Interventions

- Cervical mobilization/ manipulation
- Stretching exercises
- Coordination, strengthening, and endurance exercises



Neck pain with radiating pain

- ICD Diagnoses:
  - Spondylosis with radiculopathy
  - Cervical disc disorder with radiculopathy

Neck pain with movement coordination impairments

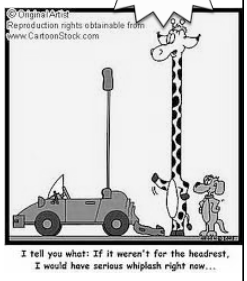
- ICD diagnosis:
  - Sprain and strain of cervical spine

Neck pain with movement coordination impairments

Moderate evidence

Key Findings

- Long-standing neck pain (>12 weeks)
- Symptoms are often linked to a precipitating trauma/ whiplash and may be present for an extended period of time



- Ergonomic inefficiencies with performing repetitive activities

Key findings

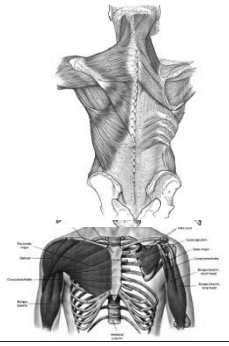
- Strength, endurance, and coordination deficits of the deep neck flexor muscles
  - Cranial cervical flexion test
  - Deep neck flexor endurance test

Strength, endurance and coordination deficits:

- Middle trapezius
- Lower trapezius
- Serratus anterior

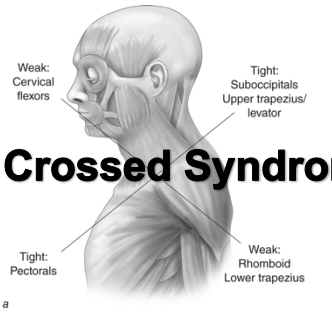
Flexibility deficits of upper quarter muscles

- Anterior/middle/posterior scalenes
- Upper trapezius
- Levator scapulae
- Pectoralis minor
- Pectoralis major



Sound familiar?

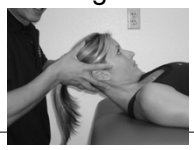
Janda (1987, 1988)



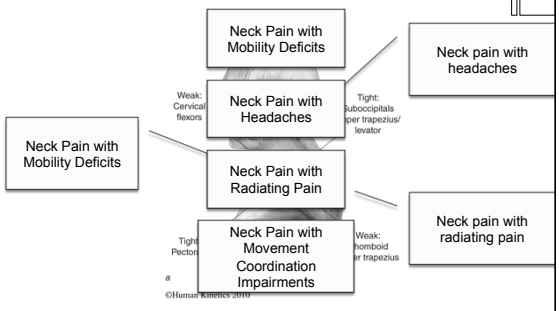
Upper Crossed Syndrome

Interventions

- Patient education and counseling
- Coordination, strengthening, and endurance exercise
- Stretching exercise



Neck Pain ICF Impairment-based Classification:

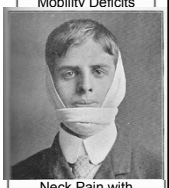


Is it fair to say:

- Faulty alignment
- Incoordinated movements
- Weakness of stabilizing muscles
- Over lengthened or short muscles

Contribute

Neck Pain with Mobility Deficits



Neck Pain with Movement Coordination Impairments

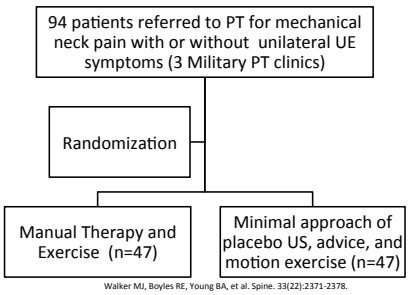
Evidence for Manual Physical Therapy Management of Cervical Spine Disorders

- Neck pain with mobility deficits/Hypomobility
- Neck pain with movement coordination impairments/Instability
- Neck pain with headache/Cervicogenic Headache
- Neck pain with movement coordination impairments/Acute pain/Whiplash
- Neck pain with radiating arm pain/ Radiculopathy

Neck Pain with Mobility Deficits/ Hypomobility

The Effectiveness of Manual Physical Therapy and Exercise for Mechanical Neck Pain

A Randomized Clinical Trial

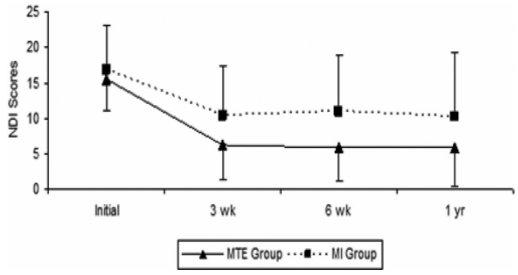


Walker MJ, Boyles RE, Young BA, et al. Spine. 33(22):2371-2378.

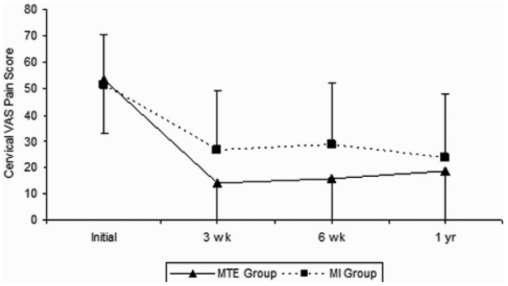
Manual Physical Therapy and Exercise

- Examination
  - Tests and measures: ROM, PIVM tests for mobility and pain provocation, upper quarter neuro screen, special tests for cervical impairments
- Evaluation
  - "**interventions specifically targeted to impairments identified during the Physical Examination**"
- Interventions
  - Thrust and non-thrust manipulation
  - Exercises to target specific impairments such as deep neck flexor strengthening
  - Both groups received 6 treatment sessions over a 3 week period (2x/week)

Neck Disability Index (0-50)



Visual Analog Scale (0-100) for Cervical Pain Scores

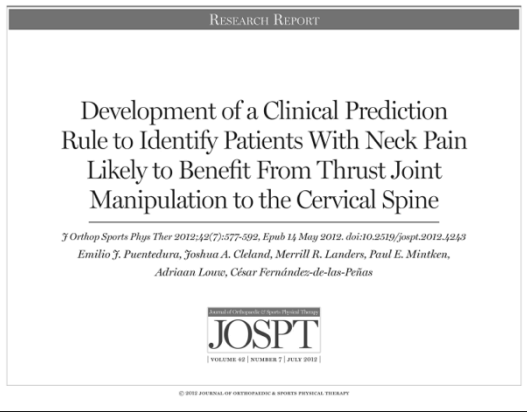


Conclusion from Walker et al.

- An "**impairment-based** Manual Physical Therapy approach" resulted in clinically and statistically significant short- and long-term improvements in pain, disability, and patient perceived recovery when compared to a program of advice, motion exercises, and sub therapeutic ultrasound

Impairment-based Approach

- Assess spinal segmental and direction of hypomobility or hypermobility
- Reproduce pain and address reactivity
- Assess strength and neuromuscular control
- Specific manipulation to address hypomobility impairments and pain
- Specific exercise to address weakness, instability, and neuromuscular control
- Integrate manipulation with Exercise


RESEARCH REPORT

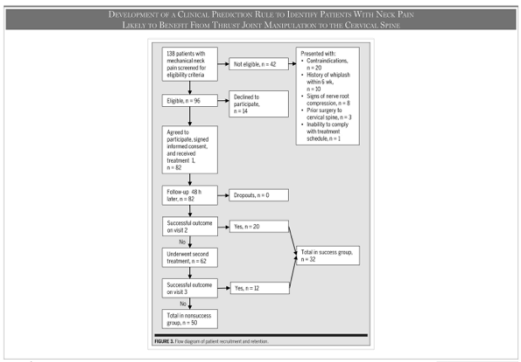
Development of a Clinical Prediction Rule to Identify Patients With Neck Pain Likely to Benefit From Thrust Joint Manipulation to the Cervical Spine

J Orthop Sports Phys Ther 2012;42(7):577-592, Epub 14 May 2012. doi:10.2519/jospt.2012.4243

Emilio J. Puentedura, Joshua A. Cleland, Merrill R. Landers, Paul E. Mintken, Adriaan Louw, César Fernández-de-las-Peñas

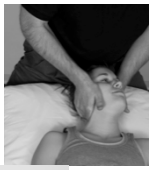
JOSPT

VOLUME 42 | NUMBER 7 | JULY 2012

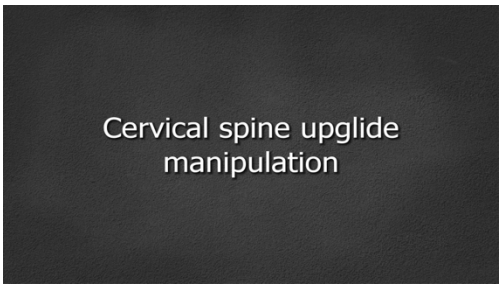


CPR for benefit of thrust manipulation of cervical spine

- Symptom duration of less than 38 days
- Positive expectation that manipulation will help
- Side to side difference of cervical rotation of 10 degrees or more
- Pain with P/A testing mid cervical spine



Cervical Spine Upglide Manipulation



Factors impacting increased likelihood of adverse reactions

- History of neck trauma
- Pain less than 1 year
- Worsening of pain since onset
- Pain ratings of 8+ on a 0-10 scale
- NDI scores 16 or more
- Moderate or severe headache
- Nausea during the past month
- Lack of confidence in the treatment

Hurwitz J Manip Phys Ther 2004

Development of a Clinical Prediction Rule for Guiding Treatment of a Subgroup of Patients With Neck Pain: Use of Thoracic Spine Manipulation, Exercise, and Patient Education

Joshua A Cleland, John D Childs, Julie M Fritz, Julie M Whitman, Sarah L Eberhart

Volume 87 Number 1 Physical Therapy

Physical Therapy

January 2007

Research Report

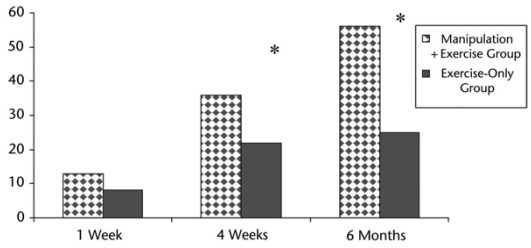
ORTHOPAEDIC SECTION
AMERICAN PHYSICAL THERAPY ASSOCIATION

Examination of a Clinical Prediction Rule to Identify Patients with Neck Pain Likely to Benefit from Thoracic Spine Thrust Manipulation and a General Cervical ROM Exercise:
Multi-Center Randomized Clinical Trail

Cleland, Mintken, Carpenter, Fritz, Glynn, Whitman, and Childs. Physical Therapy; 90(9):2010.

Manipulation + Exercise	Exercise only
2x/week x 1 wk 1x/wk x 3 wks	2x/week x 1 wk 1x/wk x 3 wks
Sessions 1 & 2 included 3 thoracic thrust mnp (TJM) techniques & neck AROM ex Sessions 3-5 were same as exercise only group	Each session included manual stretching of neck and scapular muscles and strengthening exs for DNF and parascapular muscles

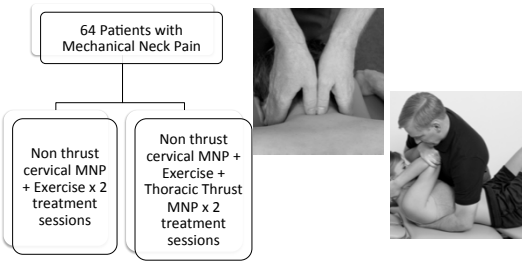
Success rates across time for each group. Success defined as scoring +5 or greater on GRoC scale. Asterisk indicates statistically signficant difference between groups.



Conclusions

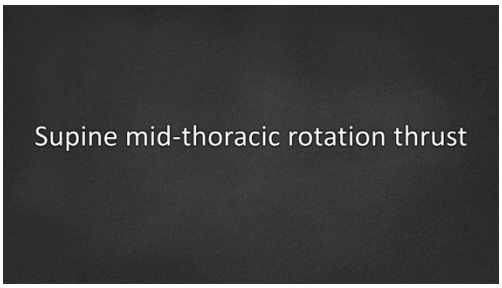
- The results of the current study did not support the validity of the previously developed CPR
- 2-way interaction between group and time suggests that **patients with mechanical neck pain** who do not exhibit any contraindications to manipulation exhibit statistically significant improvements in disability in both the short- and long-term follow-up periods with thoracic TJM

Masaracchio M,et al. Short-term combined effects of thoracic spine thrust manipulation and cervical spine nonthrust manipulation in individuals with mechanical neck pain: A randomized clinical trial. J Orthop Sports Phys Ther 2013;43(3):118-127.



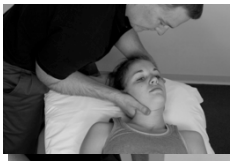
At 1 week: Combination of thoracic spine thrust manipulation + cervical spine nonthrust manipulation had better improvements in pain, disability, and global ratings of change

Supine Mid-Thoracic Rotation Thrust Manipulation



Impairment-Based Manual Physical Therapy Approach

- **Manipulate targeted Hypomobile Cervical and Thoracic Segments**
- Therapeutic Exercise
  - **ROM**
  - Motor re-training/ strengthening/ Neuromuscular control
- Postural and ergonomic education



Neck Pain with Movement Coordination Impairments/ Cervical Instability

Delphi Survey for **Symptoms** of Cervical Spine Instability

- Intolerance to prolonged static postures
- Fatigue and inability to hold head up
- Better with external support
- Frequent need for self-manipulation
- Feeling of instability, shaking, or lack of control
- Frequent episodes of acute attacks
- Sharp pain with sudden movements

Cook C et al, Identifiers suggestive of clinical cervical spine instability: a Delphi study of physical therapists. Phys Ther. 85(9):895-906,2005.

Delphi Survey for **Exam** findings of Cervical Spine Instability

- Poor coordination/neuromuscular control including poor recruitment and dissociation of cervical segments with movement
- Abnormal joint play
- Motion that is not smooth throughout range of motion including segmental hinging, pivoting, and fulcruming
- Aberrant movement

Cook C et al, Identifiers suggestive of clinical cervical spine instability: a Delphi study of physical therapists. Phys Ther. 85(9):895-906,2005.

Cranio-cervical Flexion test

- Head nod in 5 incremental stages of increasing range and hold 10 seconds
- Inferior performance has been noted in patients with neck pain and whiplash

Jull et al, Impairment of the cervical flexors: a comparison of whiplash and insidious onset neck pain patients. Manual Therapy 2004b;9:89-94.

Deep Neck Extensor Training

O'Leary et al. Arch Physical Med and Rehabil. 2011; 92: 929-34.
Schomacher et al. Manual Therapy 2012: 17(6)544-8

Impairment-Based Manual Physical Therapy Approach – Movement Coordination Impairments

- Manipulate targeted hypomobile segments **above and below region of instability**
- Therapeutic Exercise
  - **Motor re-training/ strengthening/ Neuromuscular control**
- **Postural and ergonomic education**

Neck pain with headache/ Cervicogenic Headache

Cervicogenic headache

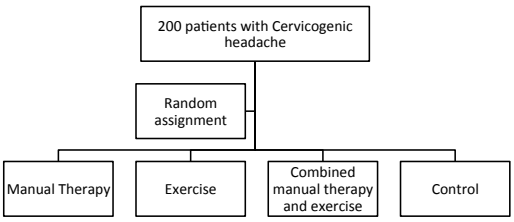
- Unilateral headache with onset preceded by neck pain
- Headache pain triggered by neck movement or positions
- Headache pain elicited by pressure on posterior neck especially at one of the 3 upper cervical joints (Jull, 2002)

Flexion-Rotation Test

Hall et al (2010 JOSPT)

A Randomized Controlled Trial of Exercise and Manipulative Therapy for Cervicogenic Headache

Gwendolen Jull, PT, PhD,* Patricia Trott, PT, MSc,† Helen Potter, PT, et al.

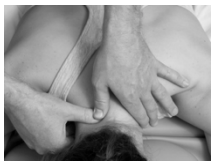
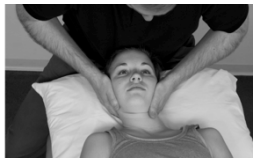
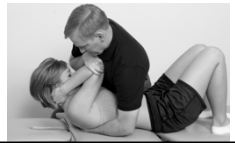


SPINE Volume 27, Number 17, pp 1835–1843, 2002

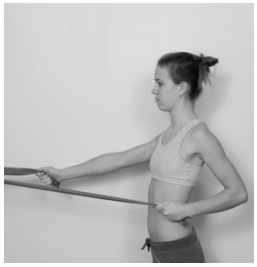
Manual Therapy interventions

- 8-12 treatment sessions with a physical therapist over a 6 week treatment period
- PTs vary treatments based on examination and re-examinations of the patients in the treatment groups.

Manual Therapy

Therapeutic exercises

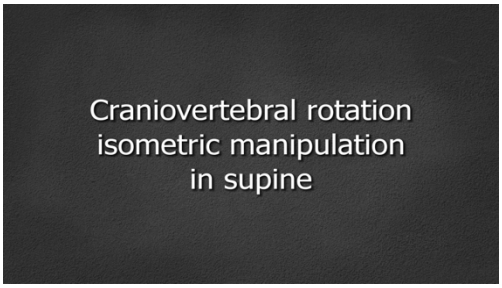
Results

- Beneficial effects were found for headache frequency and intensity and neck pain and disability for both manual therapy and exercise used alone and in combination at both 7 weeks and 12 months follow up.
- Ten percent more of the participants receiving the combined therapy obtained good and excellent results lending support for the combined use of specific therapeutic exercise and manual therapy to treat patients with cervicogenic headaches.

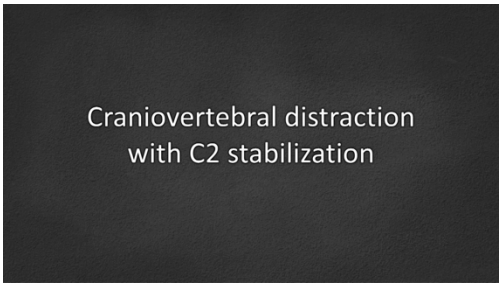
Conclusion

- Jull's study illustrates the effectiveness of an impairment based manual physical therapy approach that combines manual therapy and exercise for treatment of patients with cervicogenic headache.

Craniovertebral Rotation Isometric Manipulation



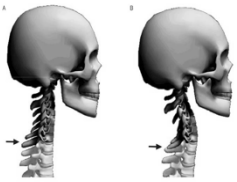
Craniovertebral Distraction with C2 Stabilization

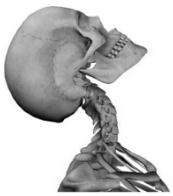


Impairment-Based Manual Physical Therapy Approach – Cervicogenic H/A

- Manipulate targeted hypomobile segments – **Target Craviovertebral mobility deficits**
- Therapeutic Exercise
  - **Motor re-training/ strengthening/ Neuromuscular control**
- **Postural and ergonomic education**

Whiplash Associated Disorders: Neck pain with movement coordination impairments/Acute pain/Whiplash





Elliott, may 2009 | volume 39 | number 5 | journal of orthopaedic & sports physical therapy

Prognostic Factors of poor outcomes from WAD

- Higher NDI(>30)
- High pain scores
- Older age
- Cold hyperalgesia
- Pressure Pain Threshold
- Post traumatic stress
- Kinesiophobia
- Greater decreased ROM
- Poor tolerance to Exam
  - Sterling, Pain, 2005 and 2006

Sterling M: Physical and psychological factors maintain long-term predictive capacity post-whiplash injury, Pain 122:102-108, 2006

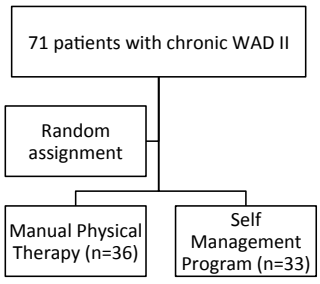
Sensory change Assessment

Cold Pain Threshold

Pressure Pain threshold

Elliott, may 2009 | volume 39 | number 5 | journal of orthopaedic & sports physical therapy

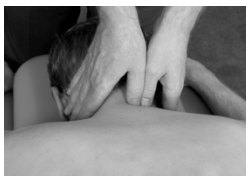
Does the presence of sensory hypersensitivity influence outcomes of physical rehabilitation for chronic whiplash?—A preliminary RCT
G Jull, PT, PhD, M. Sterling, J Kenardy, E. Beller



Pain 129 (2007) 28-34

Manual Physical Therapy

Non-thrust manipulation- low load to avoid provocation of symptoms



DNF and scapular exercises

Self Management Program

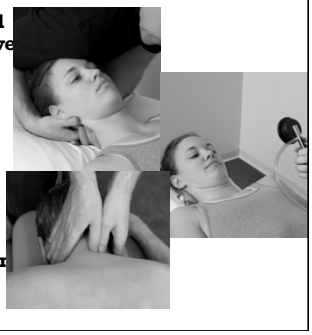
- Education Booklet
  - Assurance of recovery
  - Encouraged to stay active
- Ergonomic advice (similar to MPT)
- Home Exercise program 2x/day (similar to MPT)

Results

- MPT can reduce pain and disability in chronic WAD
- Change in DNF control improved with MPT
- 72.5% had sensory changes at baseline
- Subgroup with both widespread mechanical and cold hyperalgesia had the least improvement

Impairment-Based Manual Physical Therapy Approach - Whiplash

- **Manipulate targeted hypomobile/Reactive segments – gentle nonthrust**
- Therapeutic Exercise
  - **Motor re-training/ strengthening/ Neuromuscular control/non-provocative**
- **Postural and ergonomic education**



Neck pain with Radiating Arm Pain/Cervical Radiculopathy

Mechanical traction for neck pain with or without radiculopathy

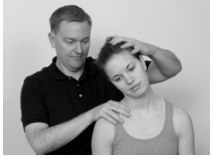
N Graham, A Gross, C Goldsmith, et al

- **Main results**
  Of the seven selected RCTs (total participants = 958), only one (N = 100) had a low risk of bias. It found no statistically significant difference (SMD -0.16: 95%CI: -0.59 to 0.27) between continuous traction and placebo traction in reducing pain or improving
- **No evidence from RCTs** with a low potential for bias **that clearly supports or refutes the use of either continuous or intermittent traction for neck disorders.**

The Cochrane Collaboration and published in The Cochrane Library 2009

Signs of cervical radiculopathy

- Limited Cervical AROM (<60*)
- + Neck Distraction Test
- + Spurling A test
- + ULND 1



Wainner RS, Fritz JM, Irrgang JJ, et al:, Spine 28(1):52-62, 2003

Predictors of Short-Term Outcome in People With a Clinical Diagnosis of Cervical Radiculopathy

96 consecutive patients referred for physical therapy for cervical radiculopathy

Baseline History & Physical Examination completed

9 Physical Therapists provided interventions based on Exam findings

Cleland, et. al. Physical Therapy. 2007. 87 (12):1619-1632

Results

Variable	Post-test probability of success
Age (<54 y)	62.9
Dominant arm is *not affected*	*62.9*
Looking down does *not worsen symptoms*	*59.5*
Multimodal treatment including manual therapy, cervical traction, and deep neck flexor muscle strengthening for at least 50% of visits	71.3

The probability of success was calculated as positive likelihood ratios and assumed a pretest probability of 53%.

Manual Therapy, Exercise, and Traction for Patients With Cervical Radiculopathy: A Randomized Clinical Trial

Ian A. Young, Lori A. Michener, Joshua A. Cleland, Arnold J. Aguilera, Alison R. Snyder

81 patients with Cervical Radiculopathy (3/4 CPR)

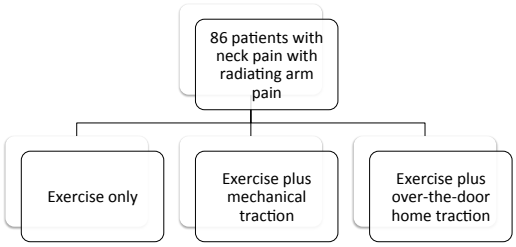
M/T, Exercise, and Intermittent traction (50on/10off) 2x/wk x 4wks

M/T, Exercise, and Sham Traction (5#) 2x/wk x 4 wks

Significant improvements noted in both groups at 2 and 4 week follow up for NDI, NPRS, and PSFS; **NO significant differences noted between the two groups**

Physical Therapy Vol. 89 (7), 2009

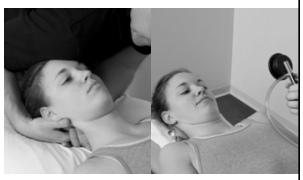
Fritz JM, Thackeray A, Brennan GP, Childs JD. Exercise only, exercise with mechanical traction, or exercise with over-door traction for patients with cervical radiculopathy, with or without consideration of status on a previously described subgrouping rule: A randomized clinical trail. JOSPT. 2014; 44(2): 45-57

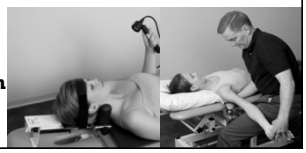


At 6 months and 12 months, the Exercise plus Mechanical Traction group had lower levels of disability (NDI scores)

Impairment-Based Manual Physical Therapy Approach - Radiculopathy

- **Manipulate targeted hypomobile segments - Cervical and Thoracic**
- Therapeutic Exercise
  - **Motor re-training/ strengthening/ Neuromuscular control**
- **Cervical Traction**
- **ULND glides**
- **Postural and ergonomic education**



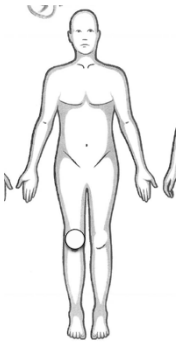


Movement Systems Impairment

Anterior knee pain

What pathological diagnosis?

Patellofemoral pain



Movement Systems Impairments

- Developed by Dr. Shirley Sahrmann
- Faulty movements and alignments contribute to musculoskeletal pain
- Diagnosis is made of the faulty alignment or movement

Movement system impairment diagnosis?

Femoral adduction internal rotation

Diagnosing the causative movement impairment/posture….

Leads to correction of the impairment…

Movement Systems Impairments

- Cervical Spine:
  - (Faulty) Extension*
  - (Faulty) Rotation*
  - (Faulty) Flexion

Faulty extension

Faulty rotation


Movement Systems Impairments

- Scapular
  - Insufficient elevation
  - Insufficient upward rotation
  - Abduction
  - Winging
  - Tipping

Movement Systems Impairments

- Thoracic Spine
  - (Faulty) Flexion*
  - (Faulty) Extension

Evidence based impairments related to neck pain

- Posture and alignment
- Impaired cervical musculature
- Scapular contribution to neck pain
- Shoulder elevation contribution to neck pain

Impaired posture and alignment

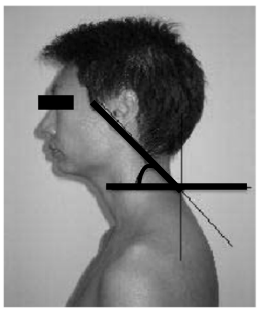
MANUAL THERAPY

The relationship between head posture and severity and disability of patients with neck pain

Chris Ho Ting Yip[a], Thomas Tai Wing Chiu[b,*], Anthony Tung Kuen Poon[c]

Manual Therapy 13 (2008) 148–154

- 62 subjects with neck pain
- 52 controls without neck pain



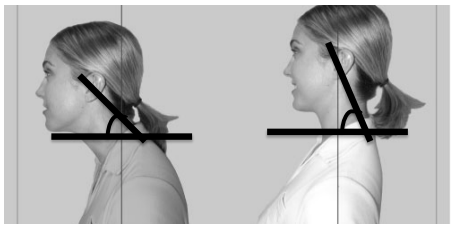
Line from spinous process of C7 through the tragus of the ear

Horizontal line through C7

Fig. 1. The craniovertebral (CV) angle.

- Intra-rater reliability ICC=0.98
- MDC=3.61°

"Subjects with neck pain revealed a significant forward head posture compared to those without neck pain"



Smaller CV angle = More head forward
Neck pain group= 49.93°

Larger CV angle = Less head forward
Control group= 55.02°

A negative correlation existed between CV angle and pain/ disability

Table 2
Pearson's correlation between CV angle, age, NPQ, NPRS and history of neck pain

	CV angle	Duration of neck pain	NPRS	NPQ	Age
CV angle	1.000	0.002 $p = 0.988$	-0.329^{**} $R^2 = 10.8\%$	-0.395^{**} $R^2 = 15.6\%$	-0.380^{**} $p = 0.002$ $R^2 = 14.4\%$
Duration of neck pain	0.002 $p = 0.988$	1.000	-0.023 $p = 0.858$	-0.110 $p = 0.396$	0.073 $p = 0.574$
NPRS	-0.329^{**} $p = 0.009$	-0.023 $p = 0.858$	1.000	0.649^{**} $p \leq 0.000$	0.470^{**} $p \leq 0.000$
NPQ	-0.395^{**} $p = 0.002$	-0.110 $p = 0.396$	0.649^{**} $p \leq 0.000$	1.000	0.324^{*} $p = 0.010$
Age	-0.380^{**} $p = 0.002$	0.084 $p = 0.517$	$0.4-0.380^{**}$ $p = 0.002$	0.324^{*} $p = 0.010$	1.000

CV angle: craniovertebral angle; NPQ: Northwick Park Neck Pain Questionnaire; NPRS: Numerical Pain Rating Scale; R^2: coefficient of determination.
*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

Relationships between sagittal postures of thoracic and cervical spine, presence of neck pain, neck pain severity and disability

Kwok Tung Lau, Ka Yuen Cheung, kwok Bun Chan, Man Him Chan, King Yuen Lo, Thomas Tai Wing Chiu*

Manual Therapy 15 (2010) 457–462

- 45 subjects without neck pain
- 47 subjects with neck pain

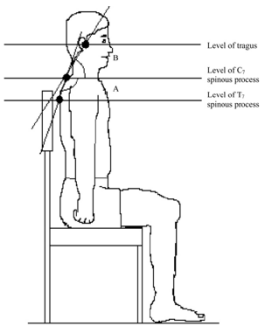


Fig. 1. Measurement of sagittal postures of thoracic and cervical spine (angle A, the upper thoracic angle; angle B, the craniovertebral angle).

Table 4
Spearman's rho correlations between Numeric Pain Rating Scale, Northwick Park Neck Pain Questionnaire and sagittal postures of thoracic and cervical spine in neck pain group.

n = 30	NPRS	NPQ	Upper thoracic angle	CV angle
NPRS		0.41* $p = 0.04$	0.43* $p = 0.01$	-0.36* $p = 0.06$
NPQ	0.41* $p = 0.04$		0.44* $p = 0.02$	-0.37* $p = 0.05$
Upper thoracic angle	0.43* $p = 0.01$	0.44* $p = 0.02$		-0.62** $p < 0.01$
CV angle	−0.36* $p = 0.06$	−0.37* $p = 0.05$	−0.62** $p < 0.01$	

NPRS: Numeric Pain Rating Scale; NPQ: Northwick Park Neck Pain Questionnaire.
*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

"Neck pain patients tended to have greater upper thoracic flexion and head forward postures"

Upper thoracic angle

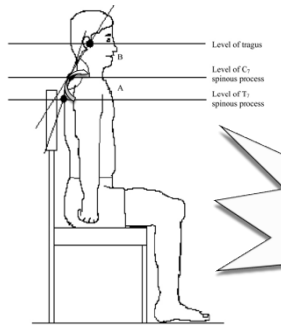
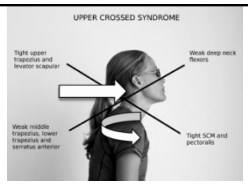


Fig. 1. Measurement of sagittal postures of thoracic and cervical spine (angle A, the upper thoracic angle; angle B, the craniovertebral angle).

- Neck pain subjects showed more upper thoracic angle (7.34°) than controls
- Positively correlated with neck pain

People with greater upper thoracic angle may be more likely to develop neck pain!

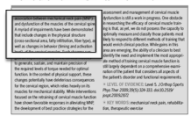


- Hanten et al. (1991)
  - Extended upper cervical spine and protracted shoulder girdles related to increased kyphosis
- Falla et al (2007) and Straker et al. (2008):
  - Flexion of the whole spine increased EMG activity in cervical erector spinae- increasing pressure on the posterior structures

Impaired cervical musculature

SHAUN O'LEARY, PT, PhD[1] • DEBORAH FALLA, PT, PhD[2]
JAMES M. ELLIOTT, PT, PhD[3] • GWENDOLEN JULL, PT, PhD[4]

Muscle Dysfunction in Cervical Spine Pain: Implications for Assessment and Management



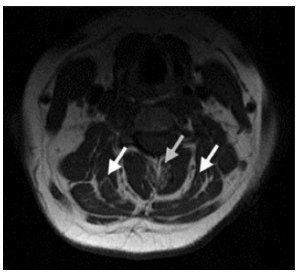
"irrefutable evidence of an association between mechanical neck pain and dysfunction of the muscles of the cervical spine"

J Orthop Sports Phys Ther 2009;39(5):324-333.

Changes in physical structure

Elliot (2006)

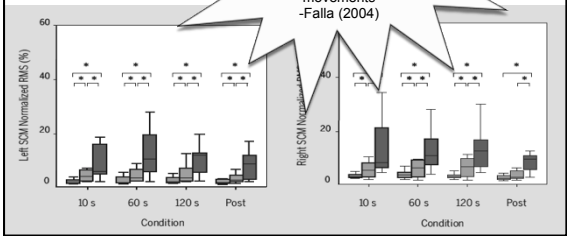
- Cross-sectional area
- Fatty infiltration
- Fiber type



Changes in behavior

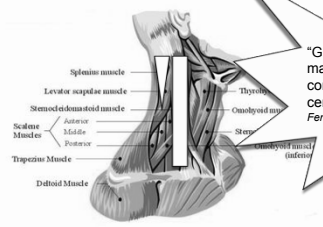
- Timing
- Activation level
- Endurance

Heightened activity of SCM and anterior scalenes during craniocervical flexion and upper-limb movements
-Falla (2004)



Heightened co-activation of superficial flexors and extensors

- Loss of well defined preferred directions of muscle action

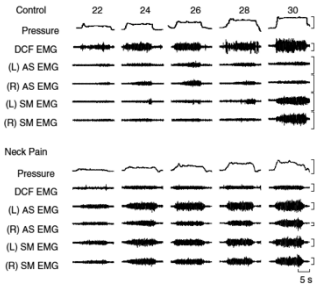


"Greater co-activation … may result in excessive compressive loads on the cervical facet joints…"
Fernández-de-las-Peñas

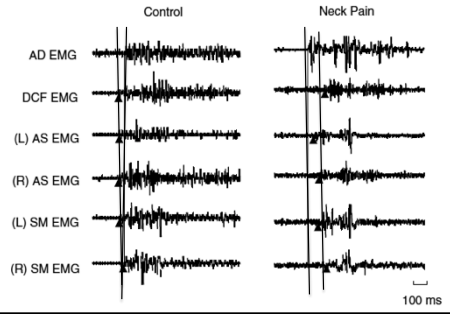
Inability to relax- repetitive upper extremity movements

- Superficial cervical flexors
- Upper trapezius

Alterations in motor control



Delayed activation of cervical musculature with arm movments



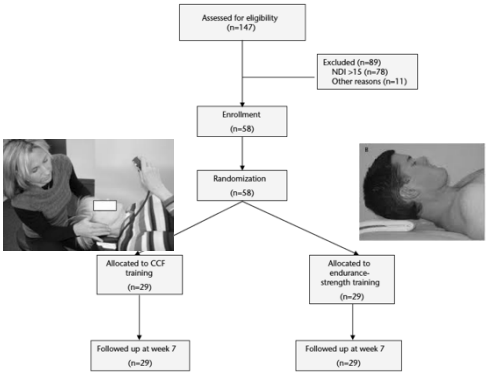
Effect of Neck Exercise on Sitting Posture in Patients With Chronic Neck Pain

Deborah Falla, Gwendolen Jull, Trevor Russell, Bill Vicenzino, Paul Hodges

Phys Ther. 2007;87:408–417

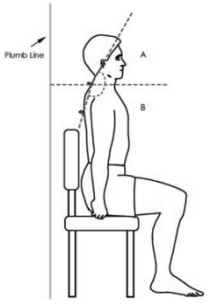
Questions:

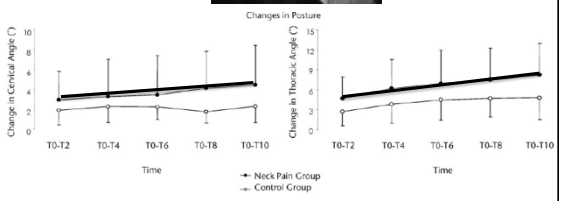
- Do people with neck pain demonstrate differences in ability to maintain upright posture when distracted
- Compare effects of low-load craniocervical flexion training vs. conventional neck flexor endurance-strength training



Methods

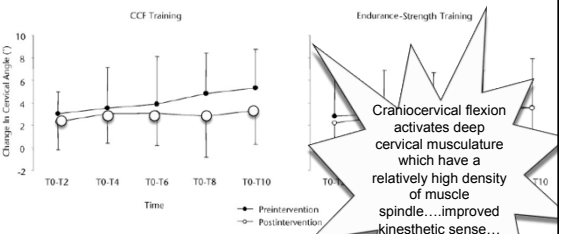
- Change in cervical and thoracic posture measured at 2 min intervals
- Total time: 10 minutes





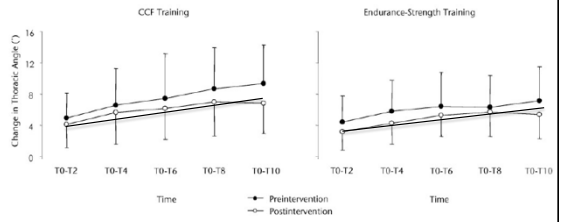
Progressive increase in change of cervical angle in neck pain group

Progressive increase in change of thoracic angle in neck pain group



Craniocervical flexion activates deep cervical musculature which have a relatively high density of muscle spindle….improved kinesthetic sense…

CCF training group showed a significant decrease in change of cervical angle during task

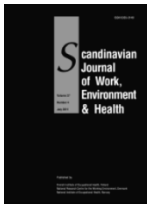


- Both training groups demonstrated improved ability to maintain thoracic angle and reduction in pain/disability

Clinical integration:

- Observation: Posture and active movements
- Engage the deep neck flexors, correct head forward posture
- Reassess active movements and symptoms
- Correction of thoracic kyphosis with reassessment of symptomatic movement

Upper extremity use and it's connection to neck pain…



Prevalence and occupational associations of neck pain in the British population

by Palmer KT, Walker-Bone K, Griffin MJ, Syddall H, Pannett B, Coggon D, Cooper C

Scand J Work Environ Health 2001;27(1):49-56
doi:10.5271/sjweh.586

Survey of 22,000 working-aged adults

- Some evidence for occupational influence on neck disorders
- Excess of neck pain in male construction workers
- Disabling neck pain in female nurses

Table 4. Risk of neck pain by occupational activity. (PR = prevalence rate ratio, 95% CI = 95% confidence interval, +ve = positive for symptoms)

Occupational activity	Past week			Past year			Preventing activity in past year		
	%+ve	PR[a]	95%CI	%+ve	PR[a]	95%CI	%+ve	PR[a]	95%CI
Men									
Average workday									
Lifting weights									
≤ 10 kg	18.1	1.0	.	31.1	1.0	.	10.8	1.0	.
10—25 kg	15.4	0.9	0.7—1.0	33.0	1.0	0.9—1.1	7.6	0.7	0.6—1.0
> 25 kg	21.1	1.1	1.0—1.3	37.7	1.1	1.0—1.2	10.7	1.0	0.8—1.2
Work with hands above shoulder height for >1 hour	23.8	1.4	1.2—1.6	42.0	1.3	1.1—1.4	11.6	1.2	1.0—1.5
Use of keyboard for >4 hours	16.0	0.9	0.8—1.1	31.4	1.0	0.9—1.1	8.1	0.8	0.6—1.0
Past week:									
Occupational exposure to hand-arm vibration	19.2	0.9	0.8—1.1	36.7	1.0	0.9—1.1	10.0	1.0	0.8—1.2
Occupational exposure to whole-body vibration	18.5	1.0	0.9—1.2	35.6	1.1	1.0—1.2	9.4	0.9	0.8—1.1
Women									
Average workday									
Lifting weights									
≤ 10 kg	21.8	1.0	.	36.5	1.0	.	12.6	1.0	.
10—25 kg	26.9	1.1	0.9—1.3	44.2	1.1	1.0—1.3	13.3	1.0	0.7—1.2
> 25 kg	26.8	1.1	0.9—1.4	42.5	1.1	0.9—1.3	19.6	1.4	1.1—1.8
Work with hands above shoulder height for >1 hour	41.0	1.7	1.3—2.1	56.6	1.4	1.2—1.6	20.3	1.3	0.9—1.9
Use of keyboard for >4 hours	23.3	1.2	1.0—1.3	39.7	1.1	1.1—1.2	12.3	1.0	0.8—1.2
Past week									
Occupational exposure to hand-arm vibration	28.5	1.2	0.9—1.5	46.6	1.2	1.0—1.4	15.0	1.1	0.7—1.5
Occupational exposure whole-body vibration	21.8	1.0	0.8—1.1	38.4	1.0	0.9—1.1	12.3	0.9	0.7—1.2

- Association with work that involved using hands above shoulder height > 1 hour

CERVICAL SEGMENTAL MOTION INDUCED BY SHOULDER ABDUCTION ASSESSED BY MAGNETIC RESONANCE IMAGING

Hiroshi Takasaki, PT, M.Sc.[1]
Toby Hall, PT, M.Sc.[2]

Spine 2009;34:E122–E126

Figure 2. Alignment angle and Rotation angle

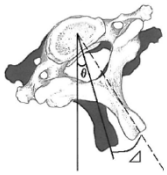
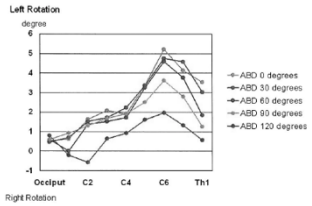


Figure 3.

- 22 pain free subjects
- Kinematic MRI at 0,30,60,90, 120 degrees of abduction

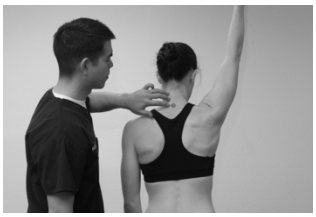
Figure 5: The rotation angles for each vertebra and each arm position. The vertical axis shows degree of rotation, positive values indicating left rotation. The horizontal axis shows each vertebra.



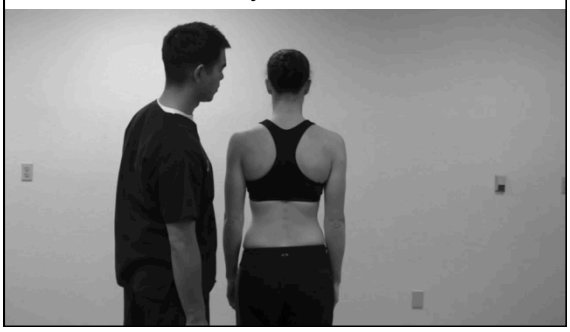
- Passive shoulder abduction has no effect
- Isometric shoulder abduction up to 90 degrees induces left rotation throughout spine
- Largest movement at C6

Cervical Rotation Movement Fault

U/L shoulder Flexion:
-- Lower Cervical rotation



Unilateral shoulder flexion- excess cervical mobility assessment



Unilateral shoulder flexion- excess cervical mobility assessment

Scapular impairment contributions to neck pain

The Immediate Effect of Passive Scapular Elevation on Symptoms With Active Neck Rotation in Patients With Neck Pain

Linda R. Van Dillen, PT, PhD,† Mary Kate McDonnell, PT, DPT, OCS,*† Thomas M. Susco, MEd, DPT, ATC,‡ and Shirley A. Sahrmann, PT, PhD, FAPTA**

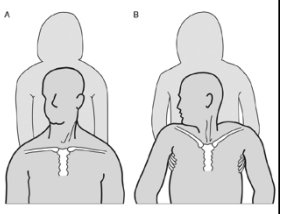
(*Clin J Pain* 2007;23:641–647)

Sample Size

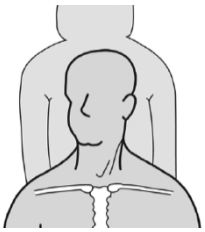
- 46 patients
- 30 women
- 16 men
- Long standing history of neck pain
- Moderate symptoms and disability

Methods

- Symptom report
- Range of motion
- A) Patient preferred posture
- B) Scapulae elevated posture

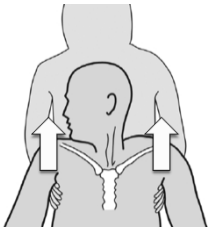


Patient preferred posture



- 29/46 (63%) reported increase in symptoms with neck rotation in patient preferred posture

Elevated scapulae



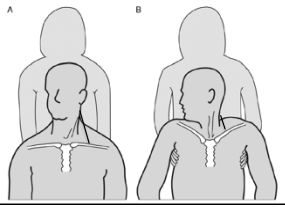
- A decrease in symptoms in right rotation (82%)
- A decrease in symptoms in left rotation (76%)

Conclusion

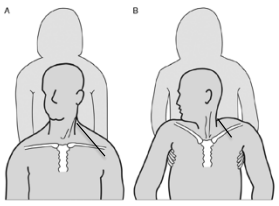
- Elevation of scapulae
  - Improved rotation
  - Reduced symptoms

Proposed mechanisms

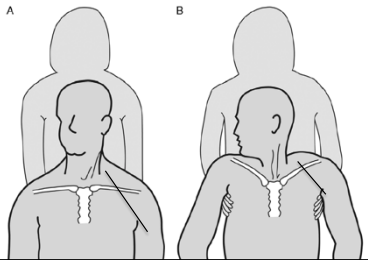
- 1. Decreased load (and weight of arms) on cervicoscapular muscles, removes **passive** stretch
- Removes **passive** limitation to rotation
- From short or stiff trapezius or levator scapulae



- 2. Elevation decreased active tension in levator scap and upper trapezius
- Schuldt et al. (1987) showed decreased EMG activity with elbows supported in work activities

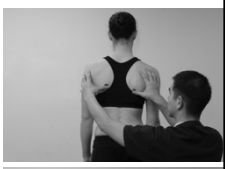


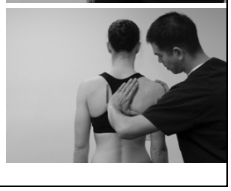
- 3. Elevation may decrease stretch on brachial plexus with head rotation



Clinical integration:

- Observation of shoulder girdle posture
- Observation of cervical movement with shoulder elevation
- Presence of radiating symptoms
- Presence of symptoms in the upper trapezius or levator scapulae
- Correction of impairments with reassessment of functional movement





- Assess effects of shoulder unloading on active movement and symptoms

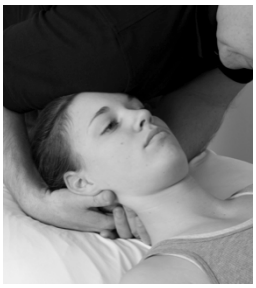
Lab Case 1:

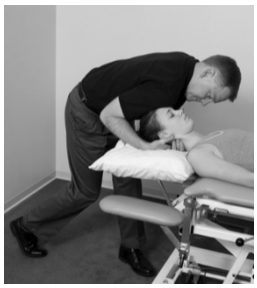
Integrated examination:

- Posture/correction
- Determine contribution of faults to pain syndrome
- Active cervical ROM and correction
- Deep neck flexor engagement in functional motion
- Deep neck flexor endurance or craniocervical flexion test
- Scapular unloading
- PAIVM and PPIVM examination of cervical spine

Craniovertebral Rotation Isometric Manipulation in supine

Craniovertebral Distraction with C2 Stabilization





Lab Case 2: