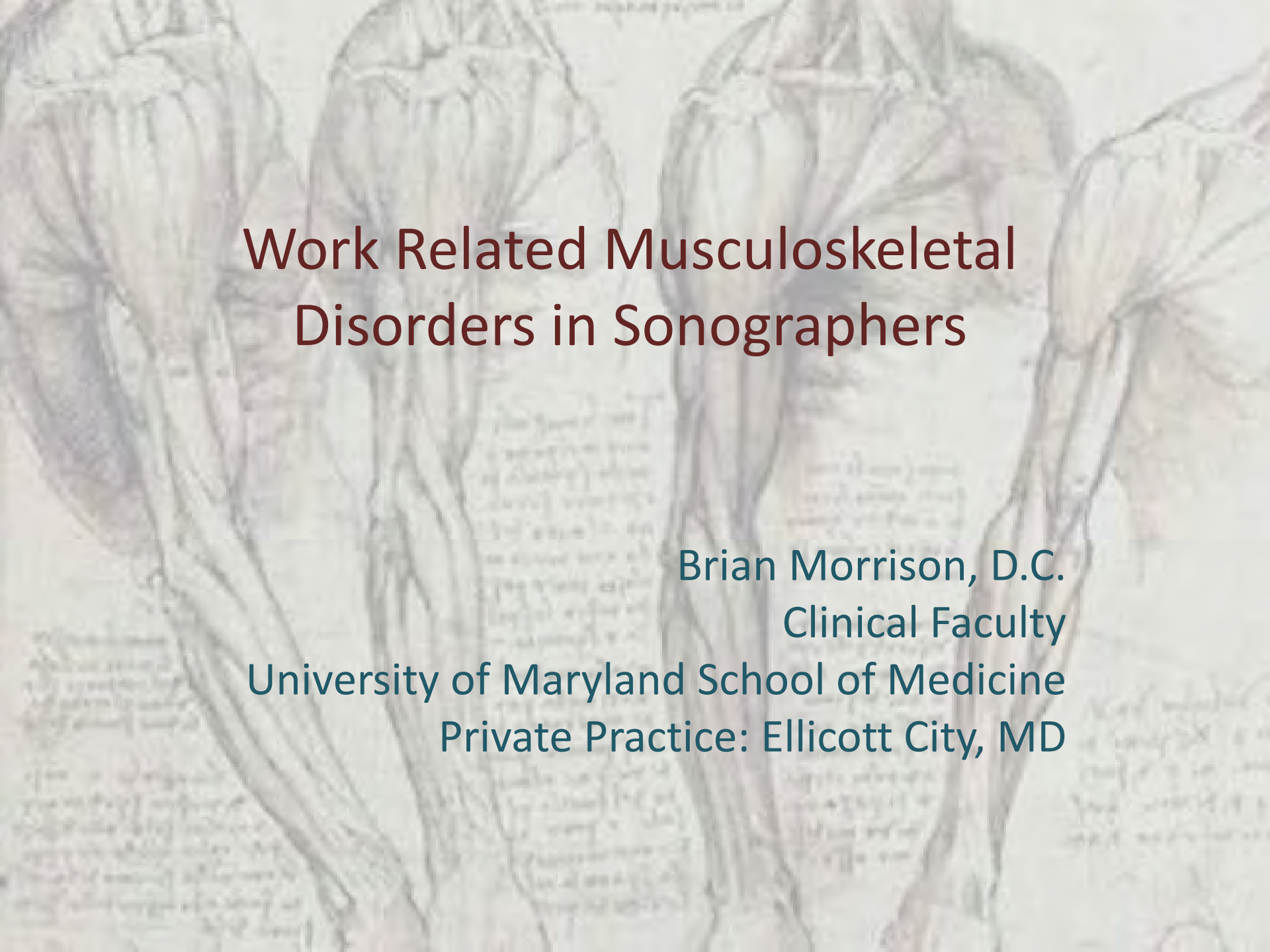




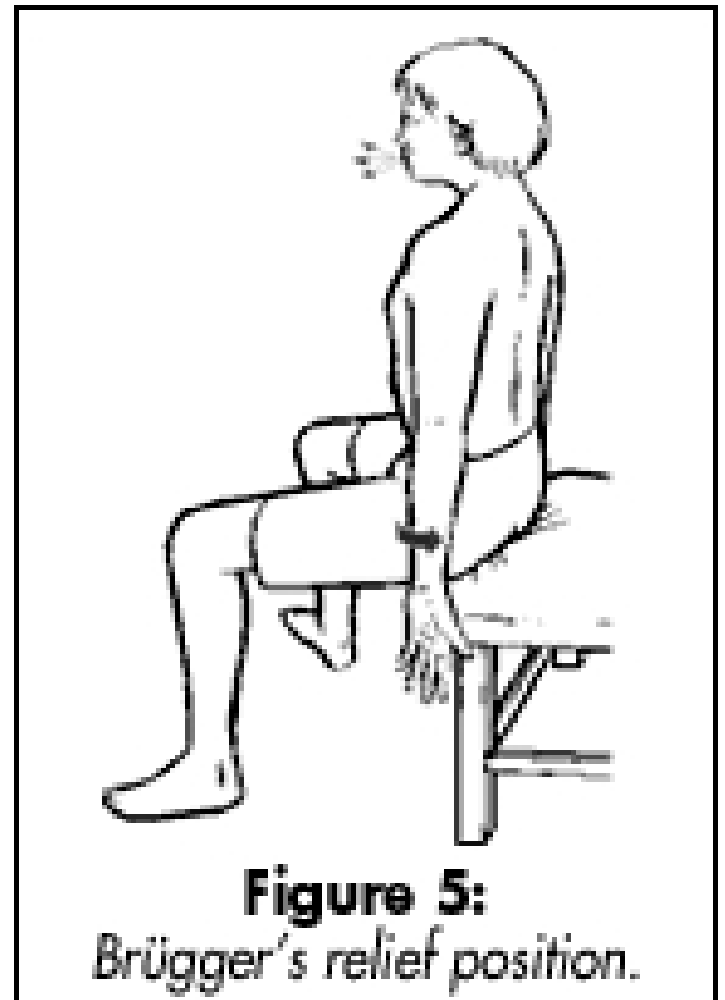
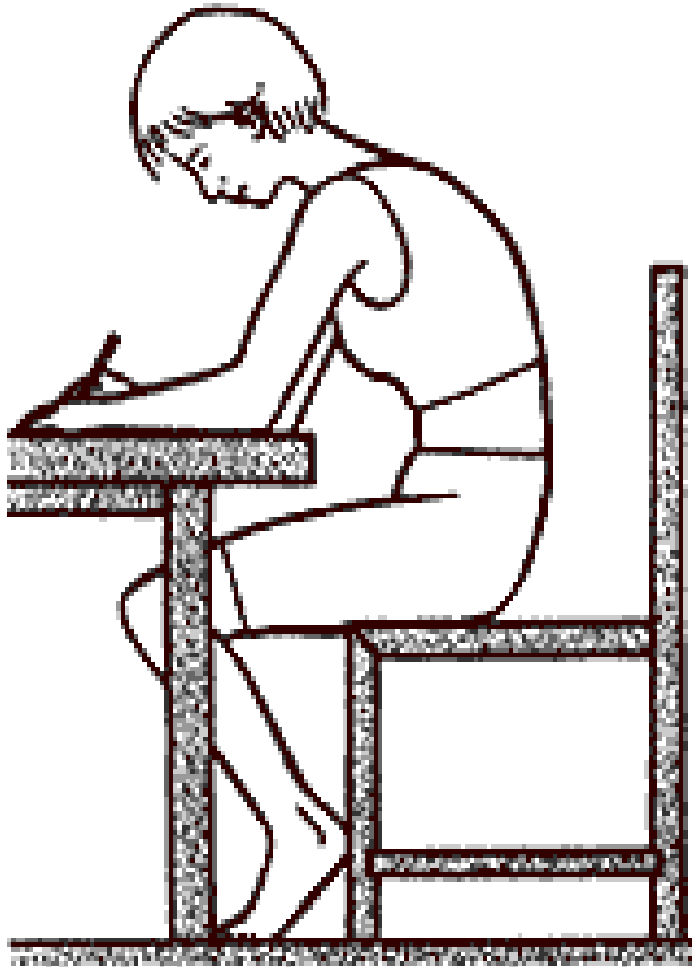
Work Related Musculoskeletal Disorders in Sonographers

Brian Morrison, D.C.
Clinical Faculty

University of Maryland School of Medicine
Private Practice: Ellicott City, MD



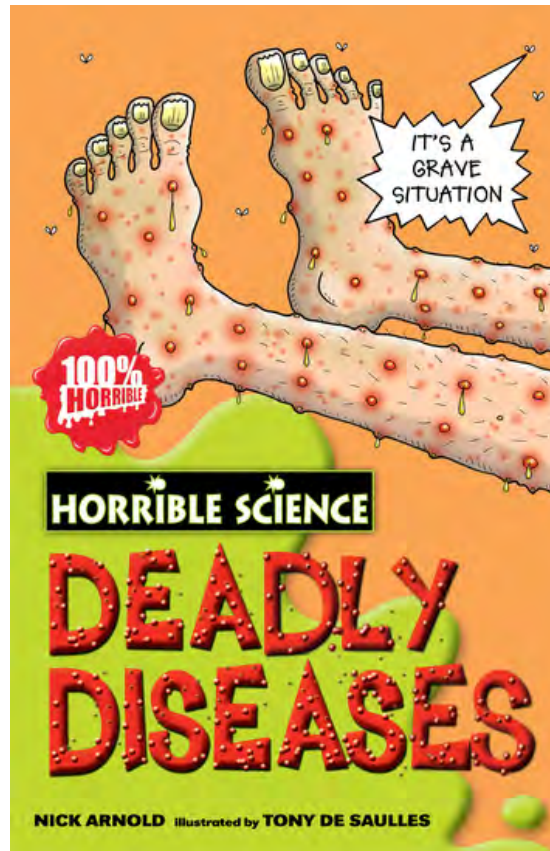
Before we begin...



Musculoskeletal (MSK) disorders are not “sexy” but’ ...

“...MSK diseases are the major cause of morbidity throughout the world, having a substantial influence on health and quality of life, and inflicting an enormous burden of cost on health systems ...”

World Health Organization 2003



- Estimate of incurred and direct costs is \$932 billion.

- Incurred costs could constitute 11% of the projected US economy in 10-15 years.
- Diminished quality of life seems inevitable and immeasurable.



Yet:

Historically, musculoskeletal medicine has occupied an extremely small proportion of the undergraduate medical curriculum.





AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS

AMERICAN ASSOCIATION OF ORTHOPAEDIC SURGEONS

“MSK-related complaints are the most common reason patients visit PCP and EDs in the United States. Despite this, significant evidence indicates that most primary care physicians do not feel adequately prepared to address such patient complaints.”

www.CartoonStock.com



search ID: dcr0574

“I'M THE ONE WITH THE MEDICAL DEGREE, I'LL DETERMINE IF YOUR BACK IS BOTHERING YOU, OR NOT...”

Current burden of MSK disease in the U.S.

1. 2 most common causes of disability are arthritis and spine problems.
2. Three of the top eight conditions presenting in ambulatory care in 2007 were for MSK disorders.
3. Account for approximately 15–30% of primary care visits in North America.
4. 110 million adults (approximately 50% of the adult population) reported having a disabling musculoskeletal condition

[Current Reviews in Musculoskeletal Medicine](#)

September 2011, Volume 4, [Issue 3](#), pp 91-98

Musculoskeletal education in US medical schools: lessons from the past and suggestions for the future

[Seetha U. Monrad](#), [John L. Zeller](#), [Clifford L. Craig](#), [Lisa A. DiPonio](#)



Incidence in sonographers

- 80–95% of sonographers experience work-related pain (1,2)
- 90% experience this pain for more than half their career (2)
- one in five sonographers sustain a career ending work-related injury (3)

**Sonographer
Minion!**



I love my Easy Job. I just sit
around pressing buttons and
taking pictures of
hearts all day.
Said no Cardiac
Sonographer
ever!



somee cards
user card

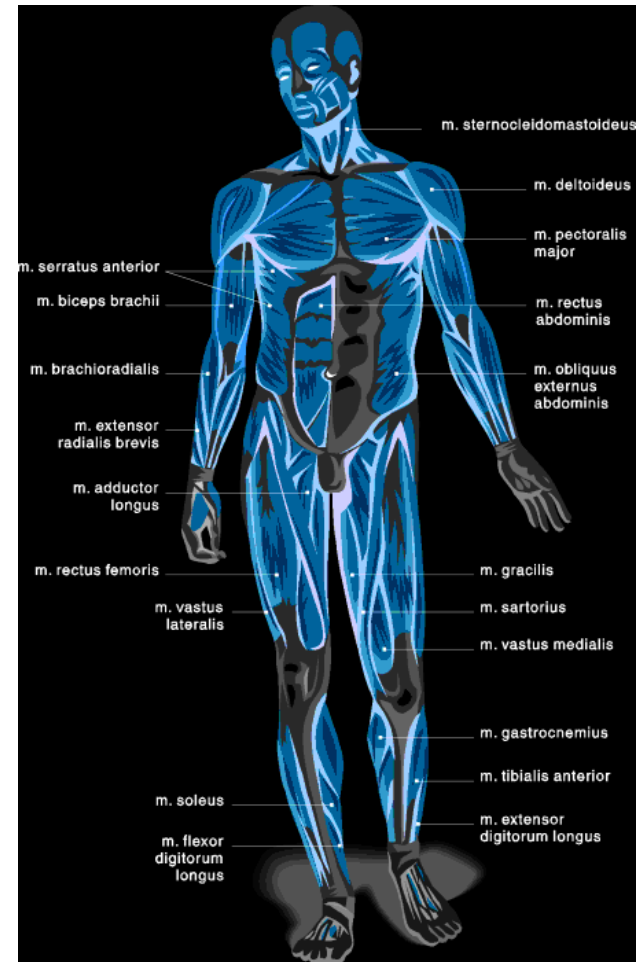
Work Related Musculoskeletal Disorders in Medical Sonographers

Involves injury to:

- Shoulder/Arm/Wrist/Hand Pain
- Acute, Recurrent, Chronic Low Back Pain with or without Sciatica
- Mid-back Pain
- Neck Pain

Tissues Involved

- Muscle
- Tendon
- Ligament
- Joint
- Nerve
- Intervertebral Discs



Primary causes of MSD in Sonographers

- Abduction of the arms.
- Lengthy examination times.
- Constant, fine repetitive movements which are often forceful or awkward.
- Increase in patient BMI, making imaging more difficult to achieve without pushing the transducer into the patient.
- Poor equipment design, forcing sonographers to sustain awkward postures
- The combination of all of the above.

The more awkward,
and more prolonged,
the higher the risk.



I am ordering an
echo for you...

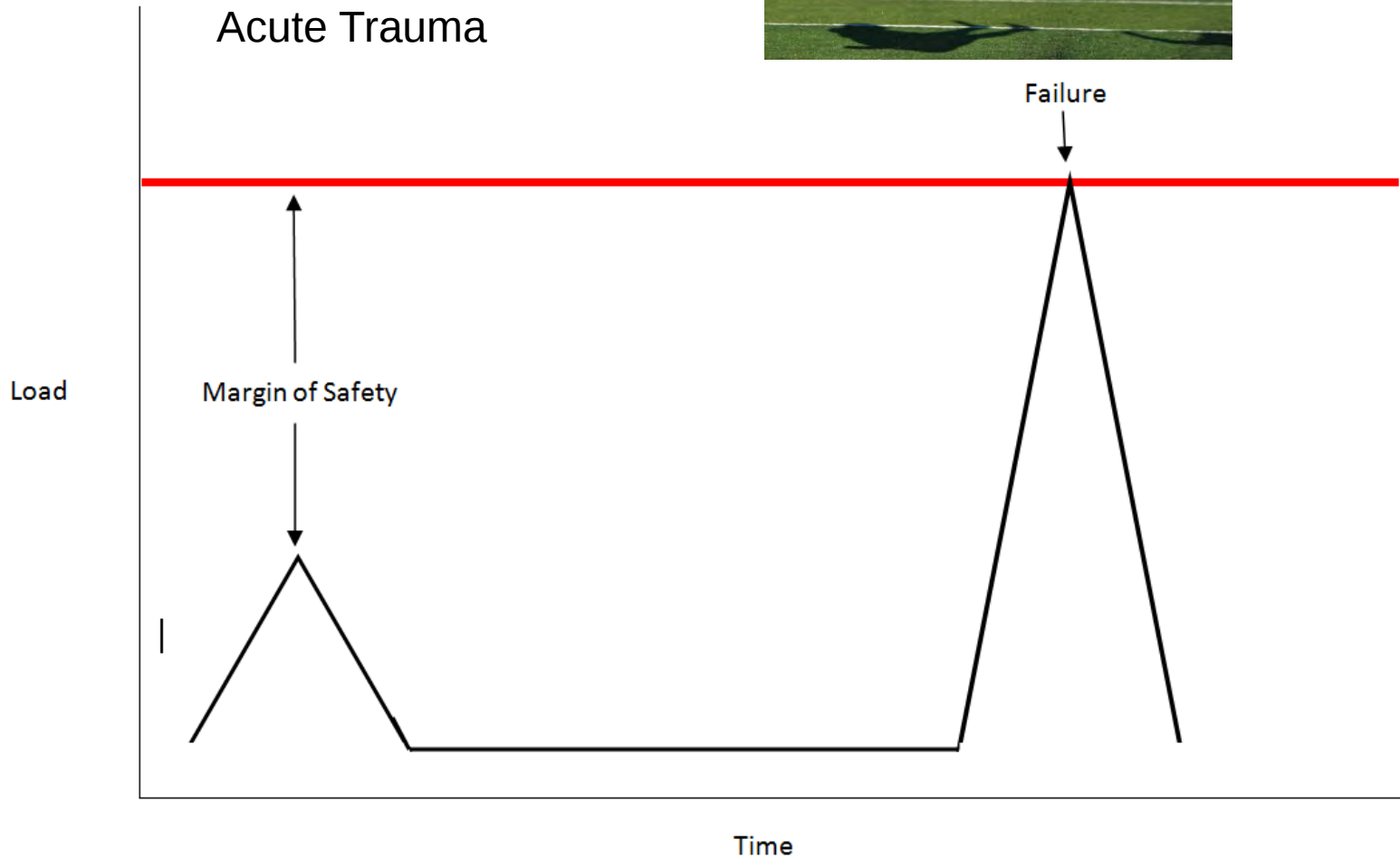


Synonyms for work-related musculoskeletal disorders (WRMSD)

- Repetitive Strain Disorder- RSD
- Repetitive Strain (Stress) Injuries- RSI
- Cumulative Trauma Disorders- CTD
- Cumulative Injury Disorder- CID
- Repetitive Motion Disorder- RMD



Acute Trauma



Adapted from McGill, 2016

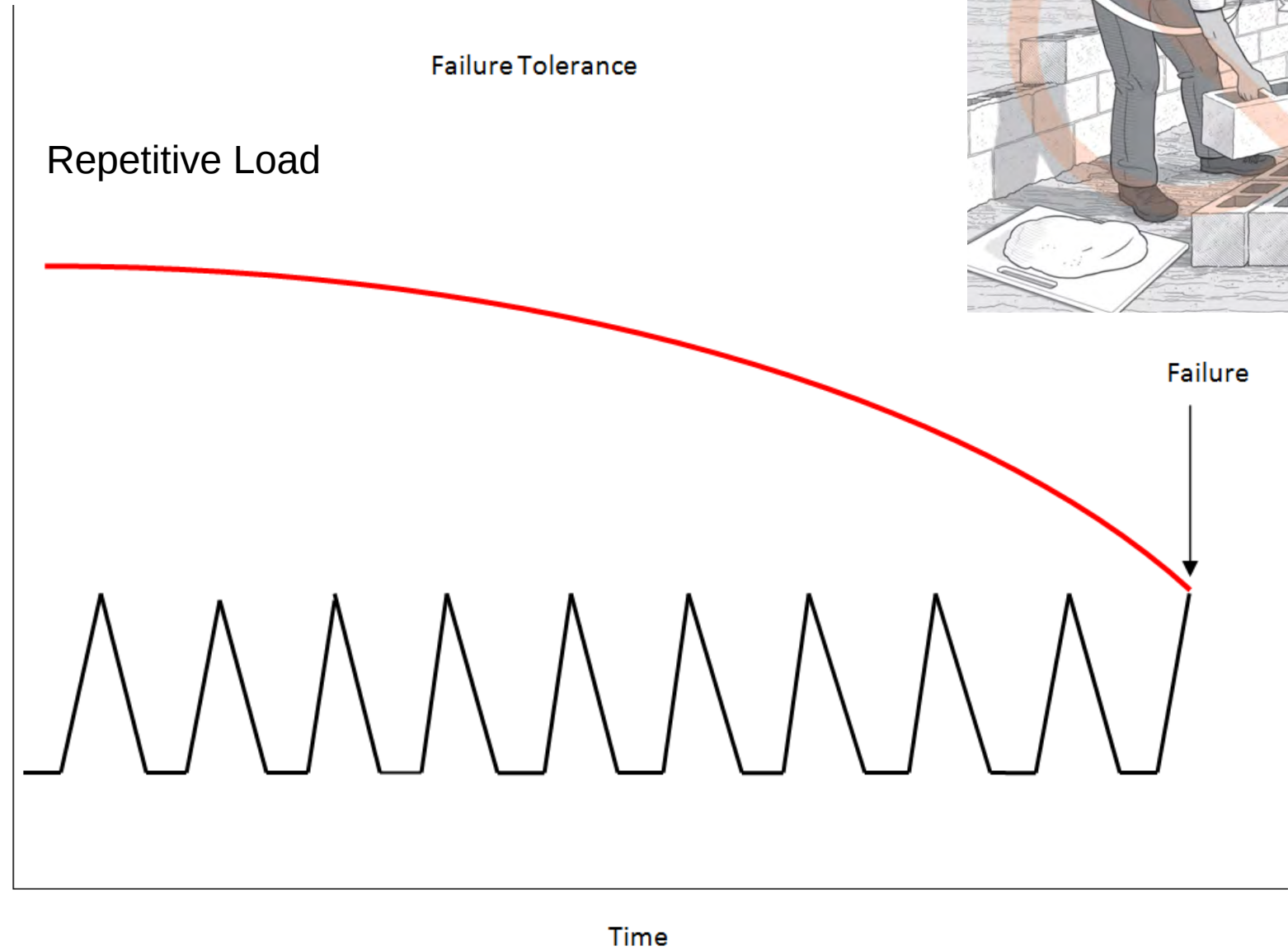


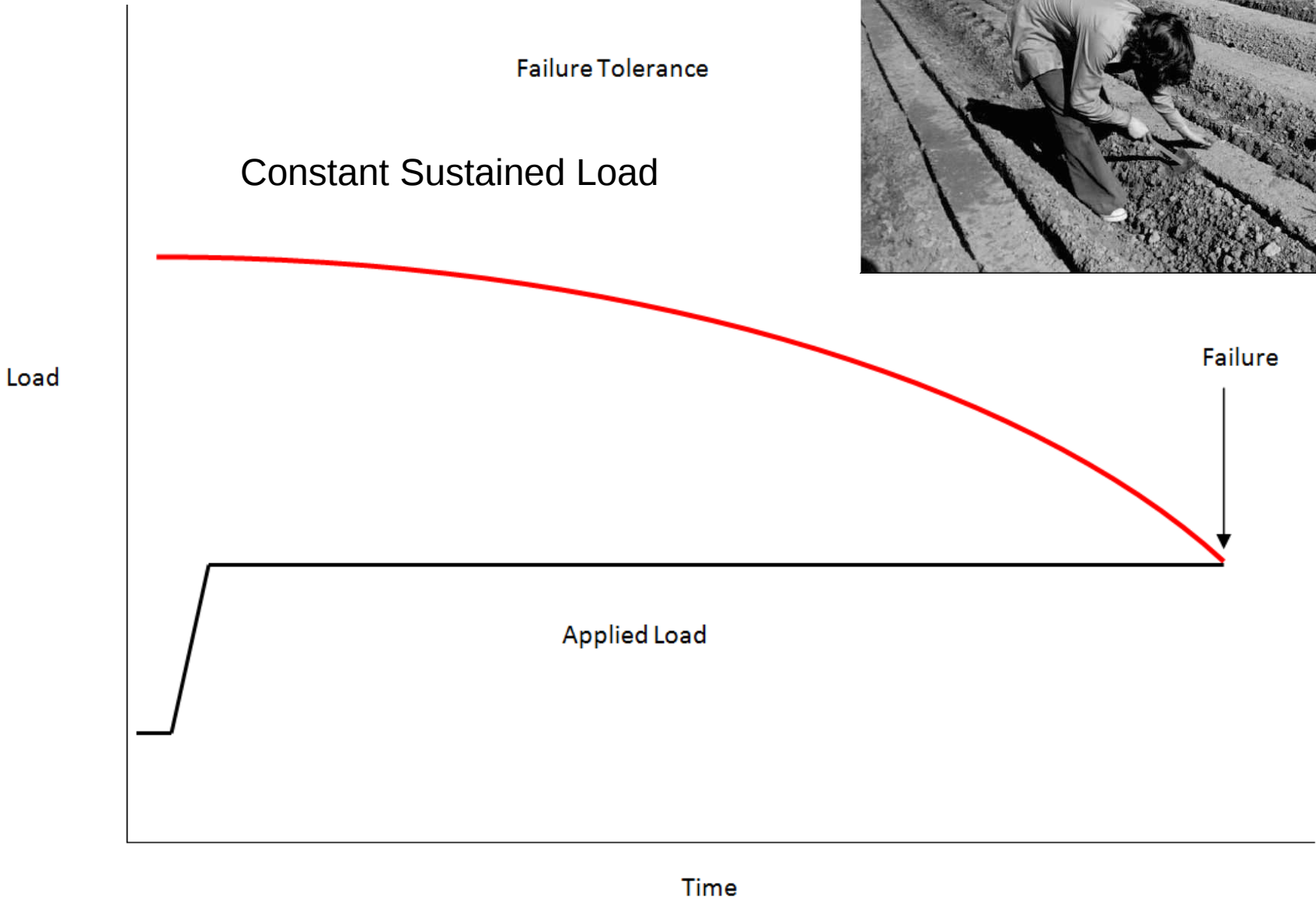
Failure Tolerance

Repetitive Load

Load

Failure





Normal Tissue Healing Following Injury

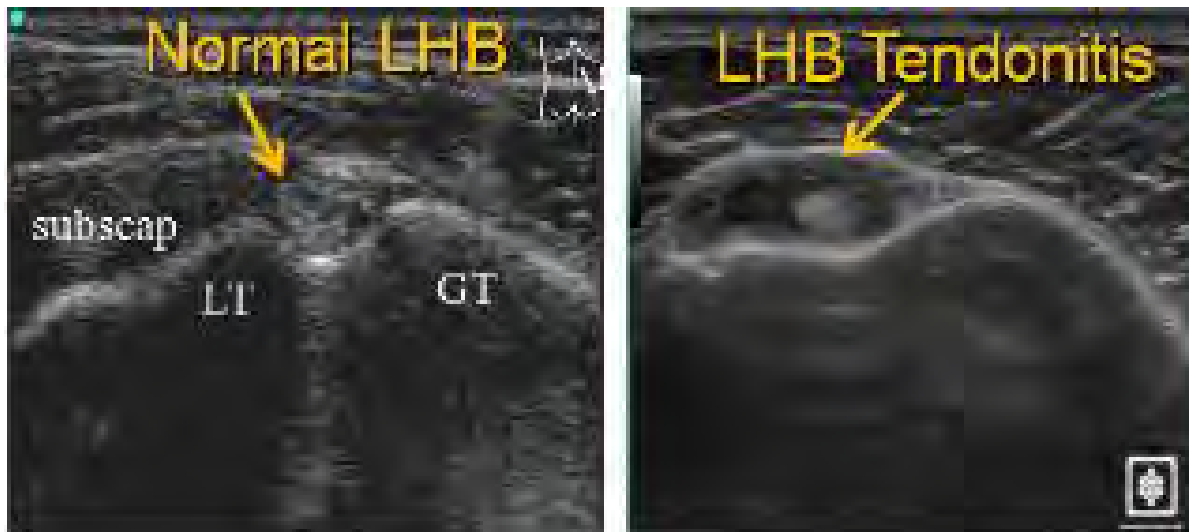
Phase I: Inflammation

- Lasts 24 – 72 hours
- Influx of inflammatory cells and blood.
- Muscle tension, pain and tissue irritation



Phase 2: Congestion

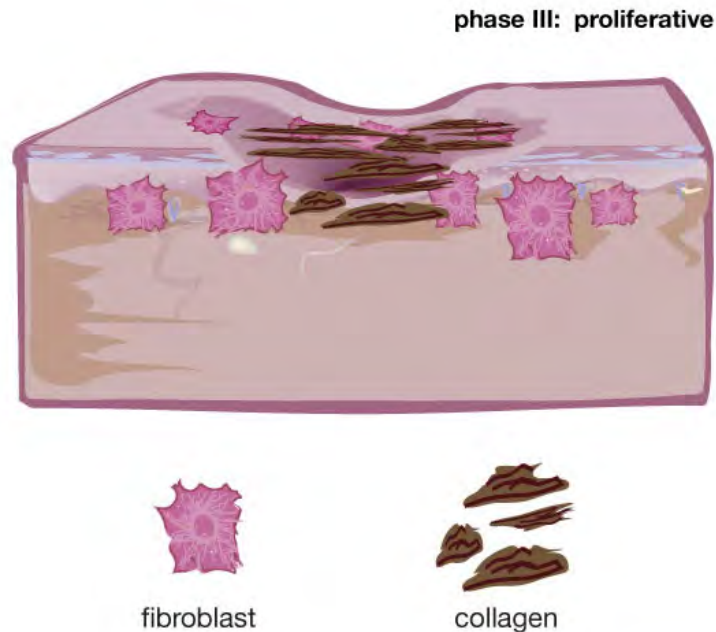
- From 2 days to 2 weeks
- Fluids become trapped among muscle fascicles in a non-homogenous fashion.



LHB = Long Head, Biceps Tendon

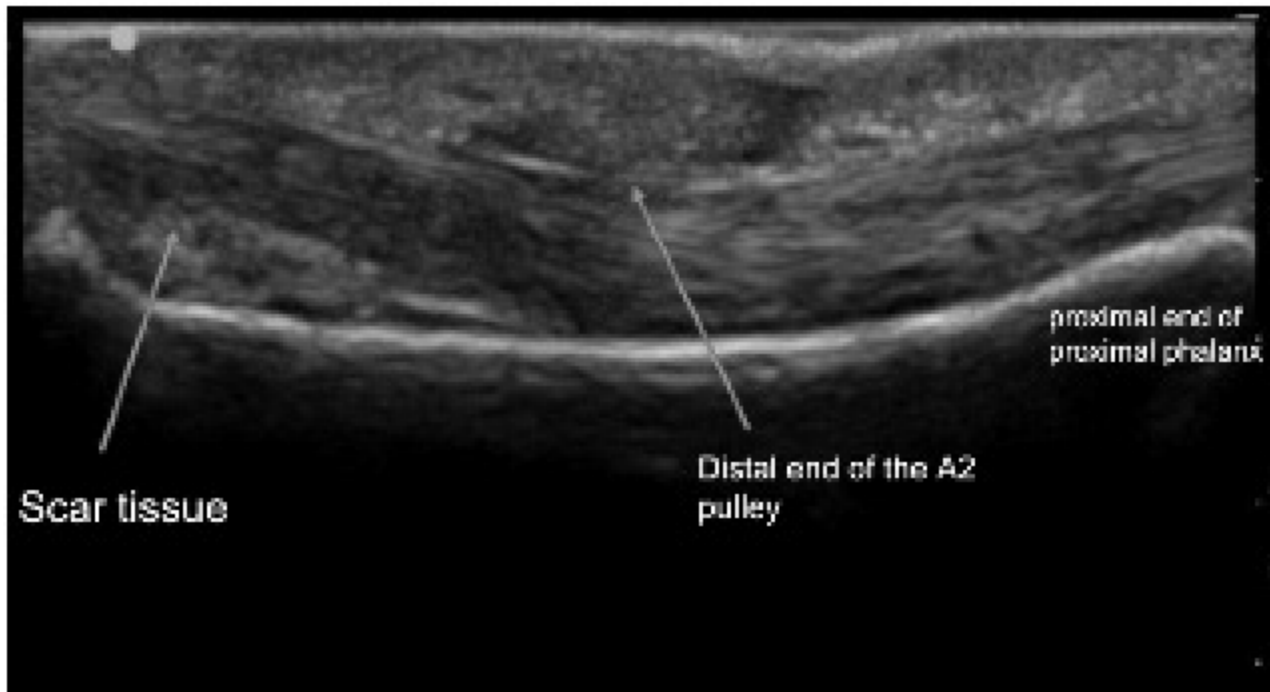
Phase 3: Proliferative Phase

- From 2 weeks to 3 months
- Fibroblasts recruited to area
- New extracellular matrix laid down



Phase 4: Maturation

- 3 months and beyond.
- Functional tissue is laid down and healing is complete.

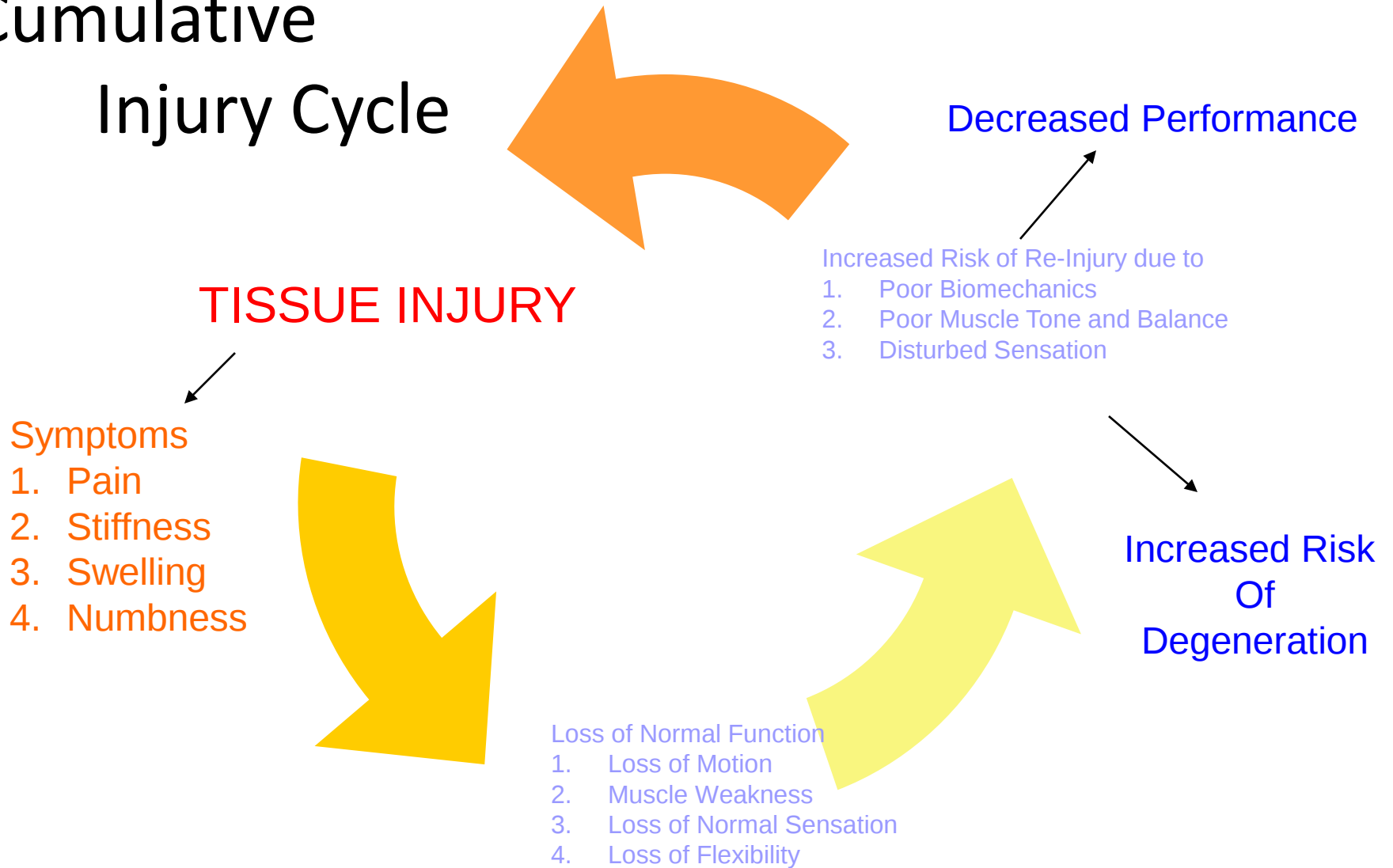


Cumulative Injury Cycle

If the repair process is compromised or source of injury persists a self-perpetuating downward spiral of tissue injury, incomplete or disrupted repair, degeneration finally produces painful, disabling symptoms and syndromes.



Cumulative Injury Cycle



Factors that compromise repair process

- Injury mechanism continues
- Aging
- Circulation compromised - smoking, diabetes, PVD, mechanical (T.O.S.)
- Thyroid deficiencies- increased muscular tension
- Hormonal changes secondary to menopause, hysterectomy, pregnancy and obesity.
- Poor general physical preparedness = low fitness

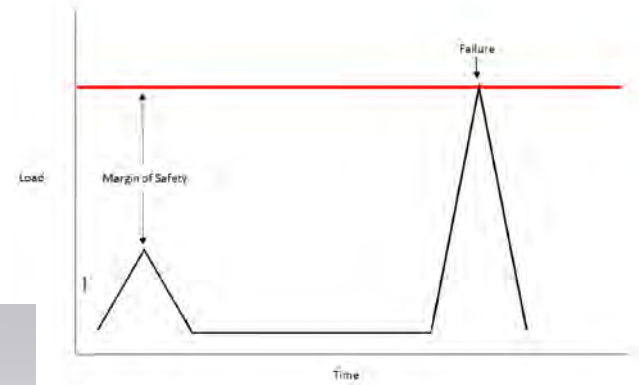


Disorders and Syndromes Associated with WRMSD

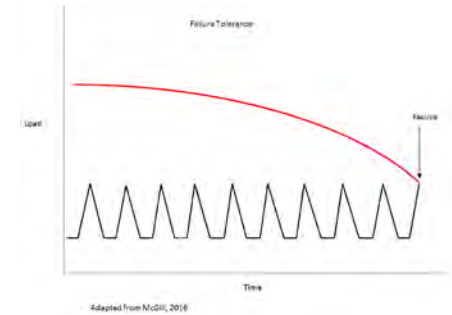
- Acute
- Repetitive Motion
- Constant Pressure/Tension

You are my 16th
scan...
today!

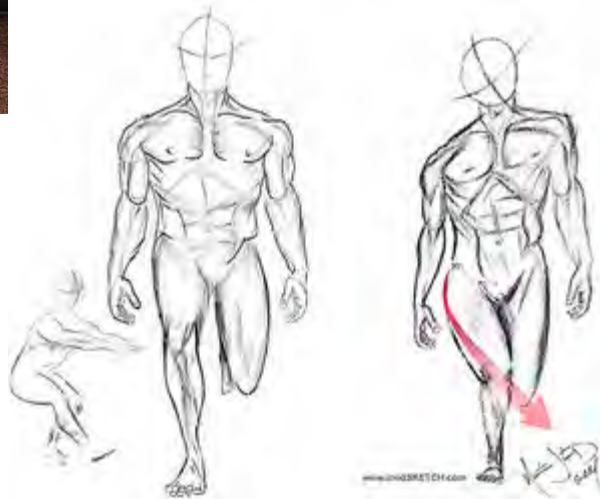
Acute



MSD types- Repetitive Motion

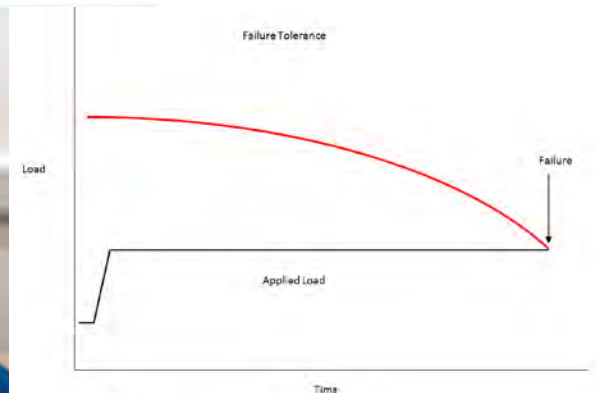


Repetitive compression loading at the hip



MSD types – Constant Pressure/Tension Injury

- Constant pressure/tension injury will decrease circulation and compromise cell recovery.
- Results in poor repair and altered function.
- Does not require a repetitive motion.
- Examples: sustained isometric contraction or the muscle tension of faulty static posture.





Sonographers often suffer from a combination of acute, repetitive motion and constant pressure/tension MSDs

Precipitating Factors

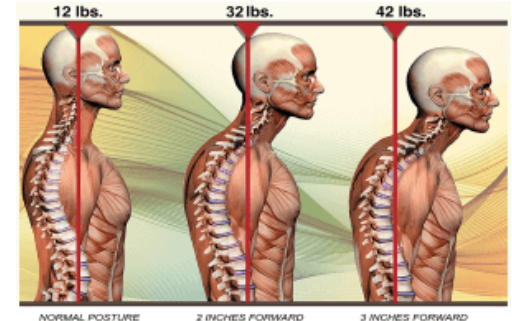


- >2 hours per day of repetitive hand movements
- Infrequent breaks, including long periods of sitting
- Patient transport/transfers
- Improper ergonomics/technique
- Sustained shoulder abduction, trunk, head and neck postures
- Create and hold sustained force into transducer head
- Improper eye-glass prescription



Pre-disposing factors

- Decreased peripheral circulation
- Faulty posture
- Poor Fitness
- Obesity
- Osteo- or rheumatoid arthritis
- History of prior low back injury
- Stress, other BioPsychoSocial factors

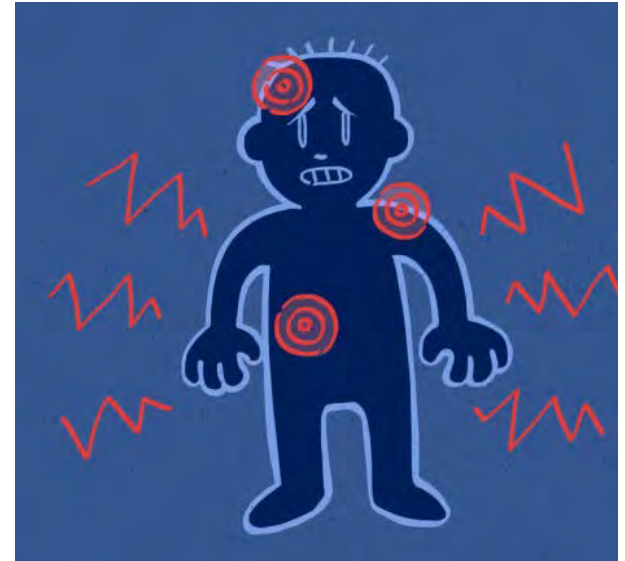


© erikdalton.com



Presenting signs and symptoms of MSD.

- Chronic neck and or back pain
- Shoulder pain
- Elbow, forearm, wrist, hand and/or finger pain
- Hand/forearm weakness, heaviness, stiffness
- Lack of endurance, fatigue
- Numbness or paresthesia
- Clumsiness
- Activity avoidance due to pain



Fear Avoidance-“Haunted House Effect”



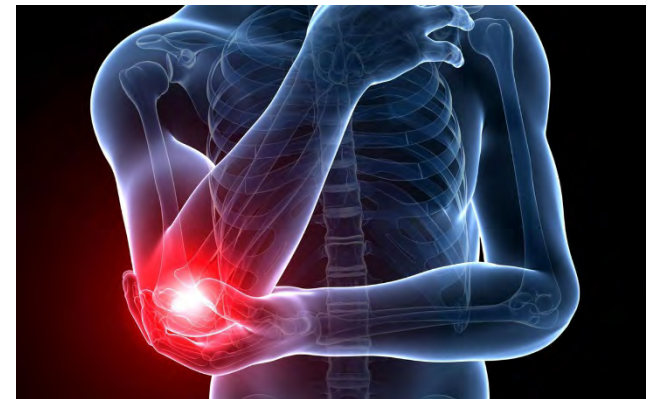
Injuries and syndromes

Classifying Injury

Tendinopathy

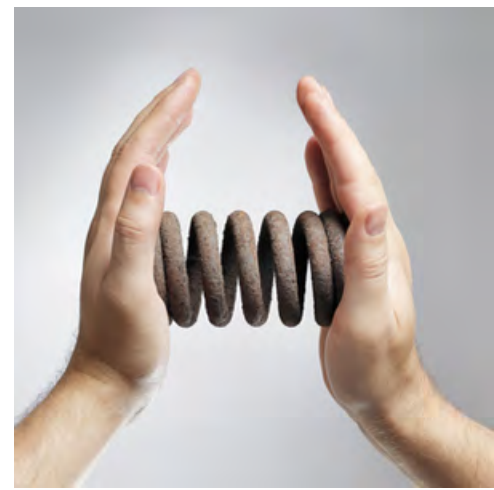
The term “tendinitis” is no longer used because studies show that **there is no inflammatory process occurring in the tendons**. Unfortunately anti-inflammatories are still Rx'd for tendinopathies.

(Khan, et al., 2002).



The key factors in the onset of tendinopathy appear to be **repetitive energy storage and release, and excessive compression**. The key word here is **compression**, not tearing in the collagen.

(Cook & Purdam, 2009)



Compressive overload can occur in three ways: rapid overload, repetitive overload or abusive overload (from blunt trauma).



Classifying Injury



Reactive tendinopathy

a non-inflammatory proliferative response in the tendon cell and matrix which occurs after acute overload.

Tendon dysrepair

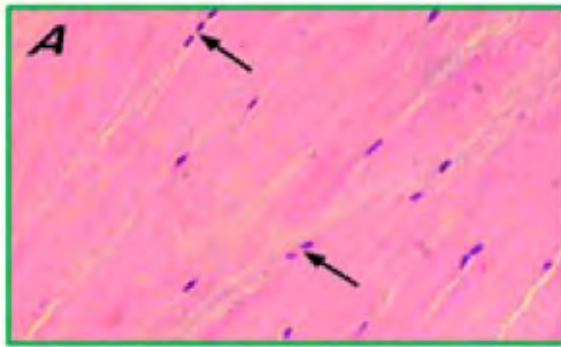
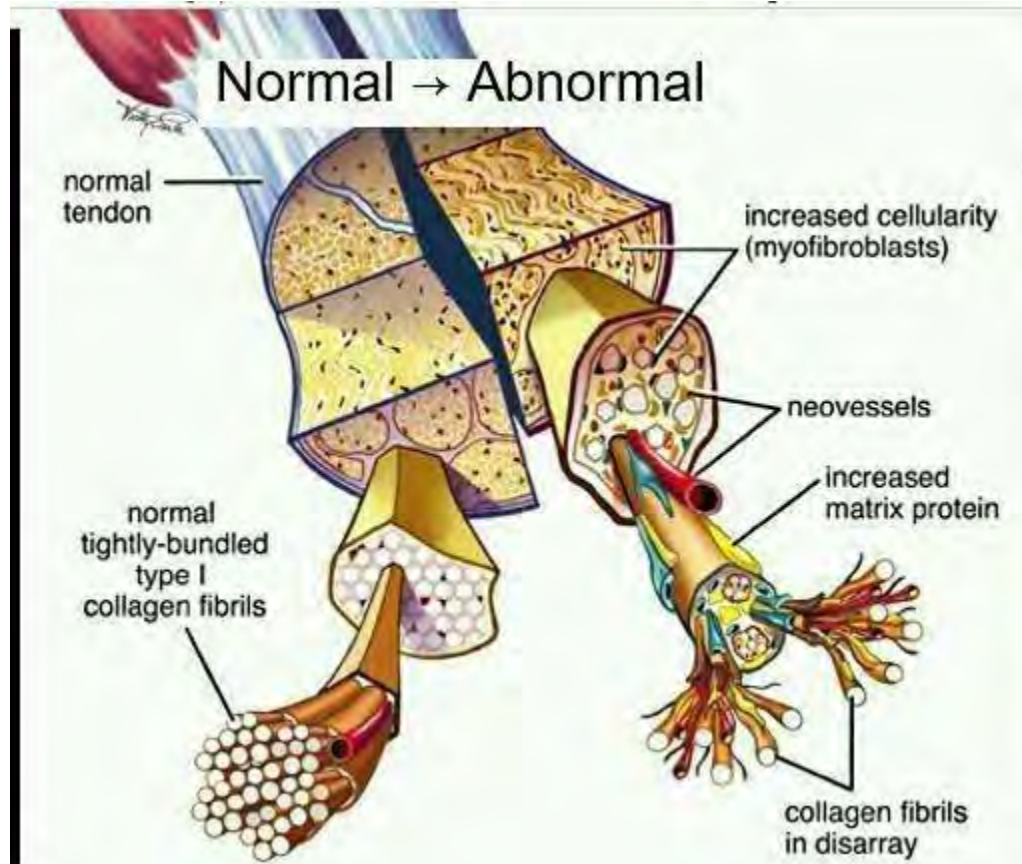
Tendon's attempt at healing causes greater matrix degradation.

Disorganization of the matrix and separation of the collagen **decreases** the loading capacity of the tendon.

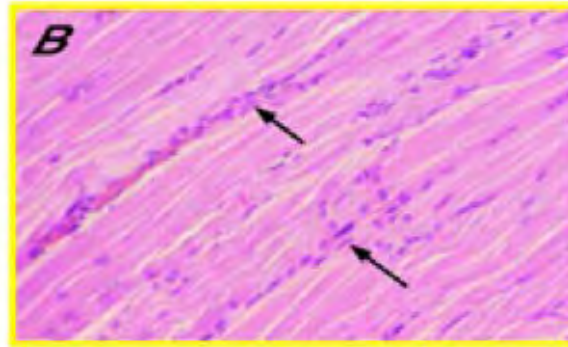
Degenerative Tendinopathy.

Cell death from apoptosis (tightly regulated programmed cell suicide process) and trauma. At this stage of pathology there is little capacity for reversibility of pathological changes

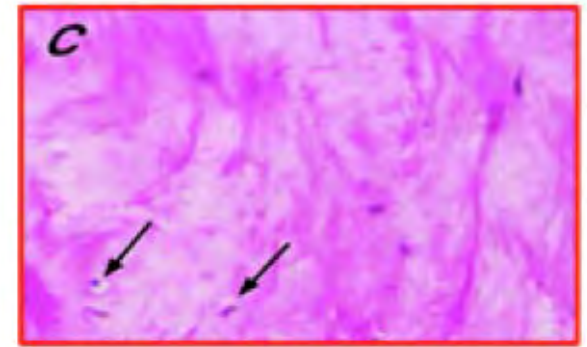
(Cook & Purdam, 2009; Magnusson et al., 2008).



Healthy



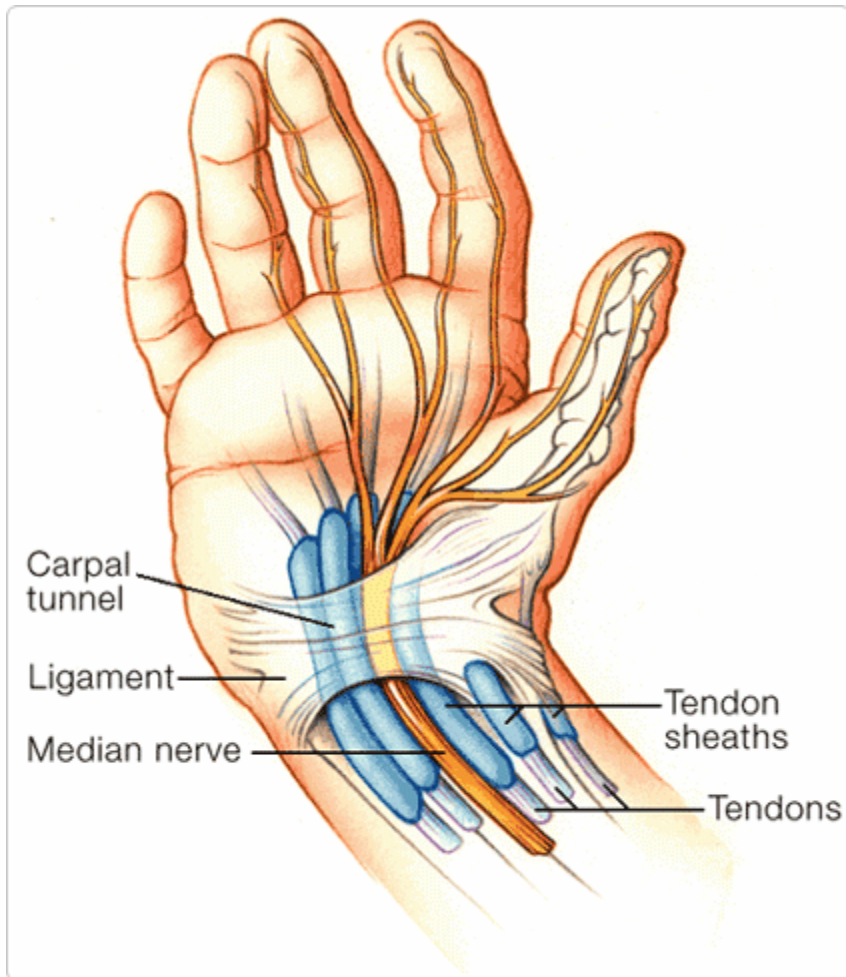
Reactive Tendinopathy



Degenerative Tendinopathy

Other WRMSDs

Carpal Tunnel Syndrome- Repetitive Motion



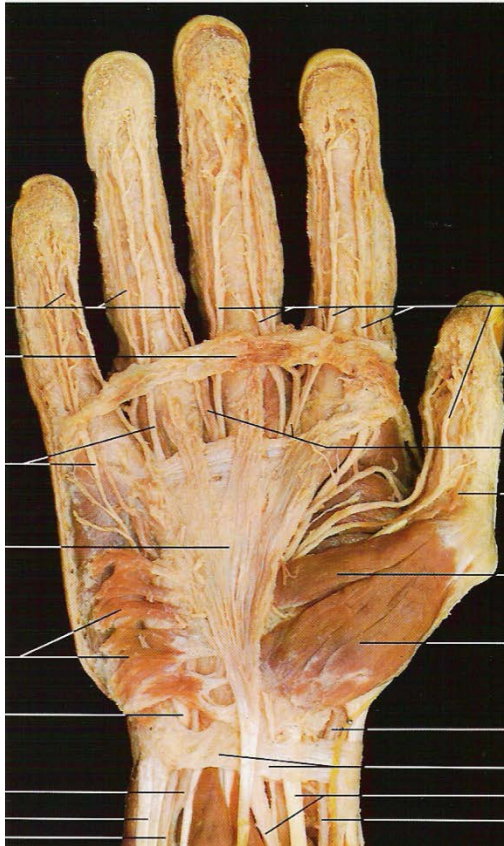
- Decrease in cross sectional area of tunnel or enlargement of tunnel contents can cause compression of the medial nerve.
- Symptoms include numbness and tingling of the thumb, middle and index finger, with or without pain, weakness and motor control disturbance

Carpal Tunnel Syndrome

- Intracarpal pressure exaggerated by wrist flexion and ulnar deviation
- Repetitive wrist flexion, finger motion, prolonged grip are risk factor.



Carpal Tunnel Syndrome

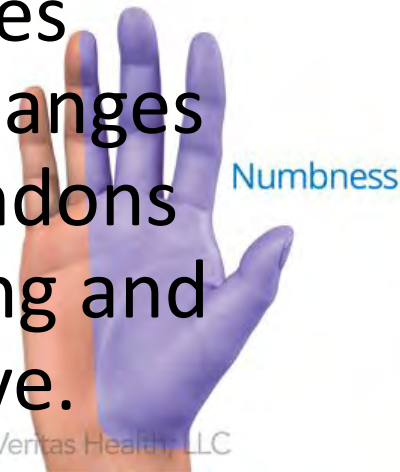


- Ultimately, impaired innervation to thenar muscles leads to thenar atrophy.

thenar muscles

Carpal Tunnel Syndrome

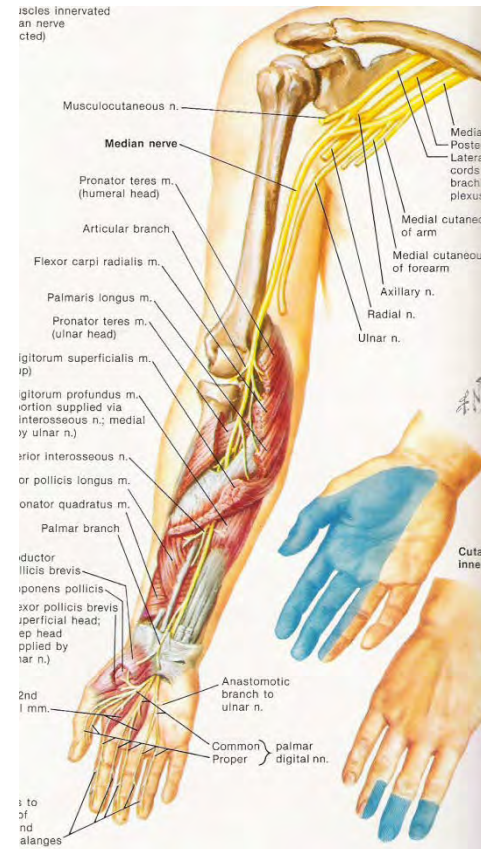
- Re-injury, compression and impairment of the repair and remodeling processes creates edema, proliferation and changes in gliding movements of tendons in the carpal tunnel, irritating and entrapping the median nerve.



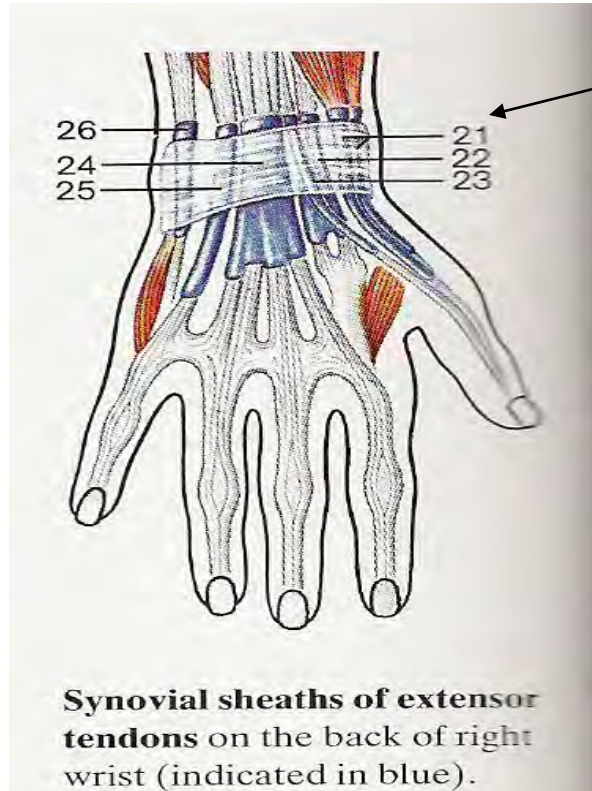
- Symptoms can include wrist, forearm, elbow or shoulder pain.

Pronator Syndrome

- Entrapment of the median nerve by WRMSD of the pronator teres muscle at the elbow can mimic Carpal Tunnel Syndrome.



de Quervain's Syndrome



- Proliferation, edema of the extensor pollicis brevis and the abductor pollicis longus sheaths where they pass through a fibro-osseous canal at the radial styloid.

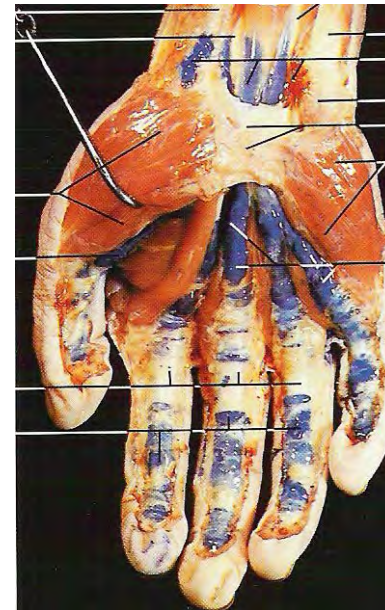
De Quervain's Syndrome



- Compression entrapment of thumb abductor and extensor muscles. Related to excessive ulnar deviation and pinch grip.
- Complicated by adhesions of the brachioradialis muscle.

Similar conditions occur in the wrist, hand and finger flexors

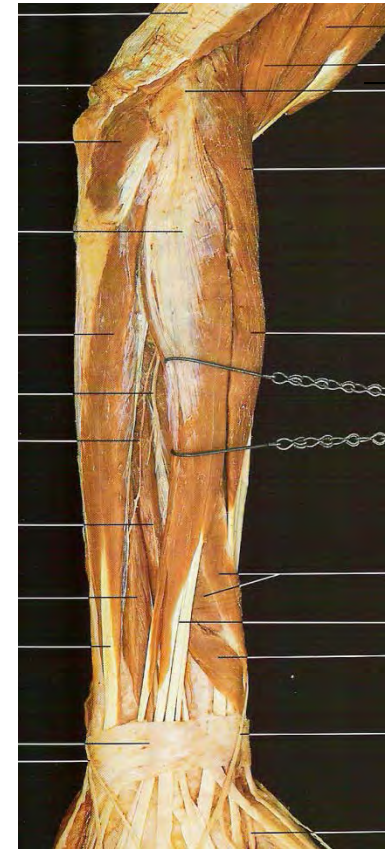
- Finger flexor tendinopathy (includes trigger finger)



Elbow WRMSDs

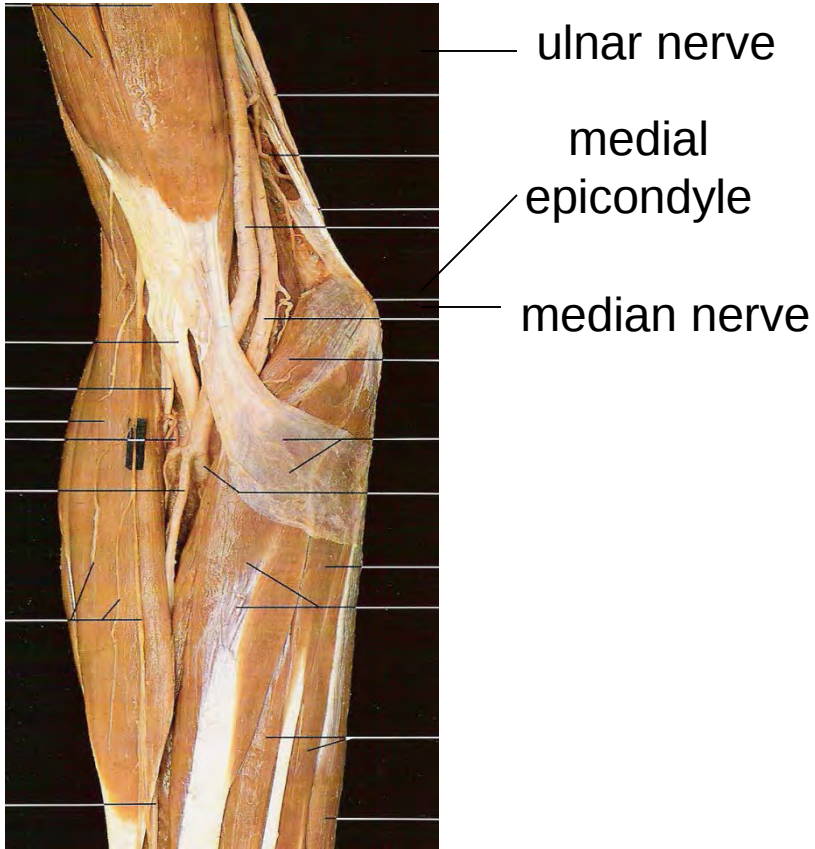
Lateral elbow tendinopathy

- Lateral elbow pain and tenderness at the lateral epicondyle and areas of the wrist extensor muscles.
- Overuse and compression -acute or repetitive motion.
- Age 35-55
- Inadequate conditioning
- Predisposing factors (gout, estrogen deficiency, hereditary connective tissue disorders).



Lateral
epicondyle

Medial Elbow Tendinopathy



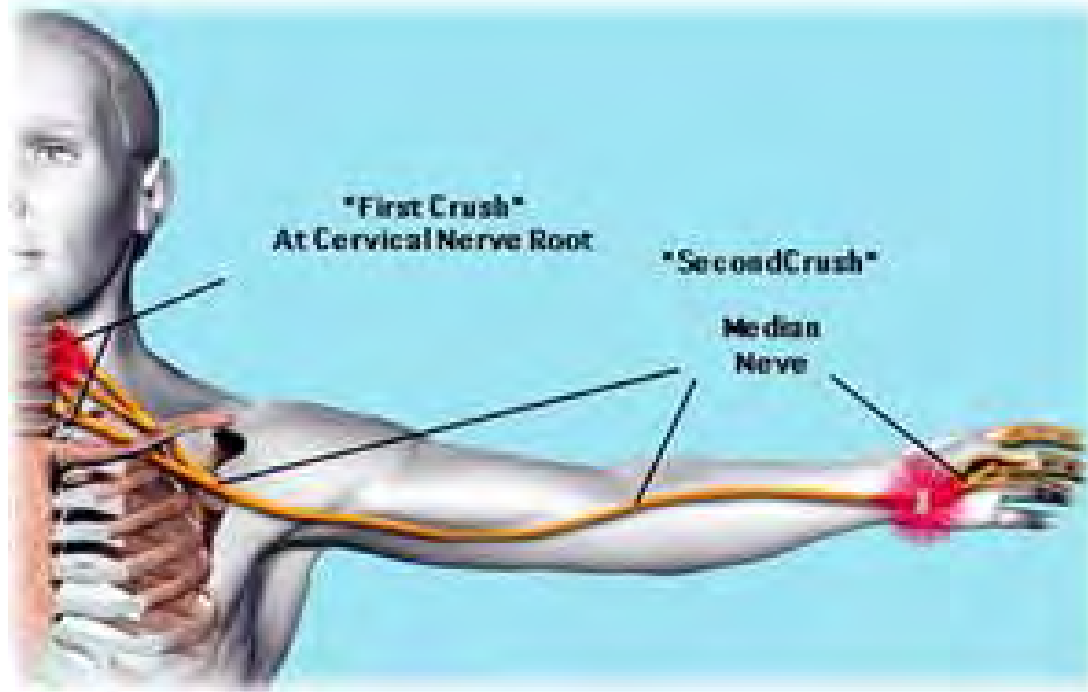
- Pain at medial epicondyle and proximal forearm flexors
- Associated with overuse in wrist flexion and pronation
- May have associated ulnar nerve entrapment up to 60% of the time.

Entrapment Neuropathies

Symptoms depend on the type of nerve affected and the amount of compression. May include:

- cutaneous sensory loss
- pain
- paresthesia
- weakness
- paralysis in severe cases
- must distinguish from polyneuropathies ie. diabetes, alcoholism.

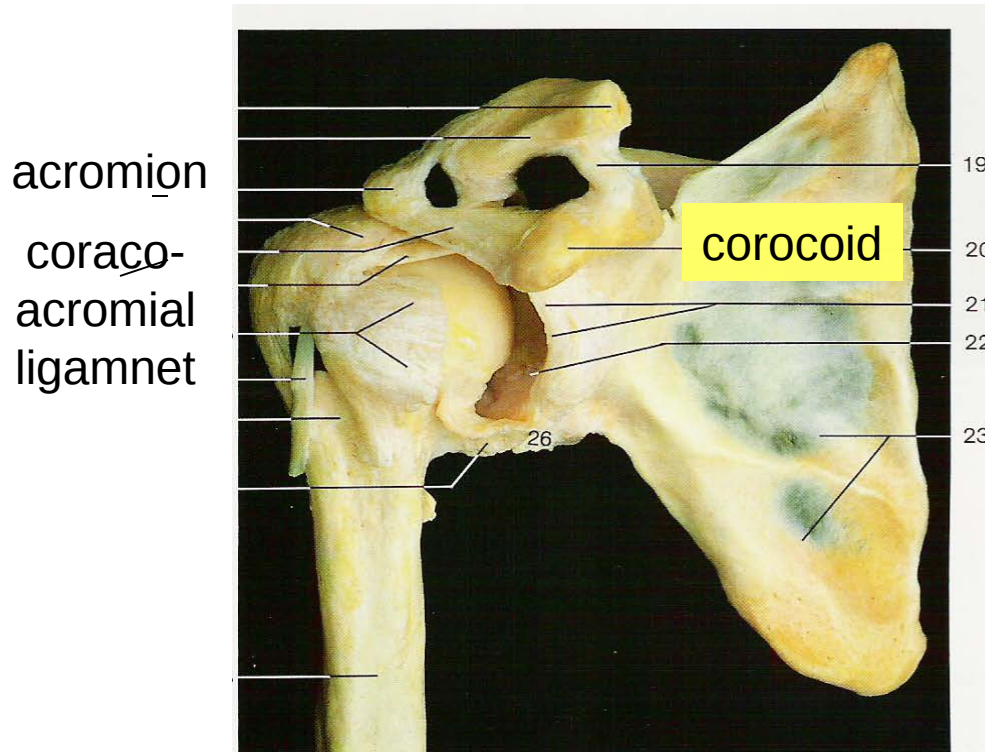
Radiculopathy



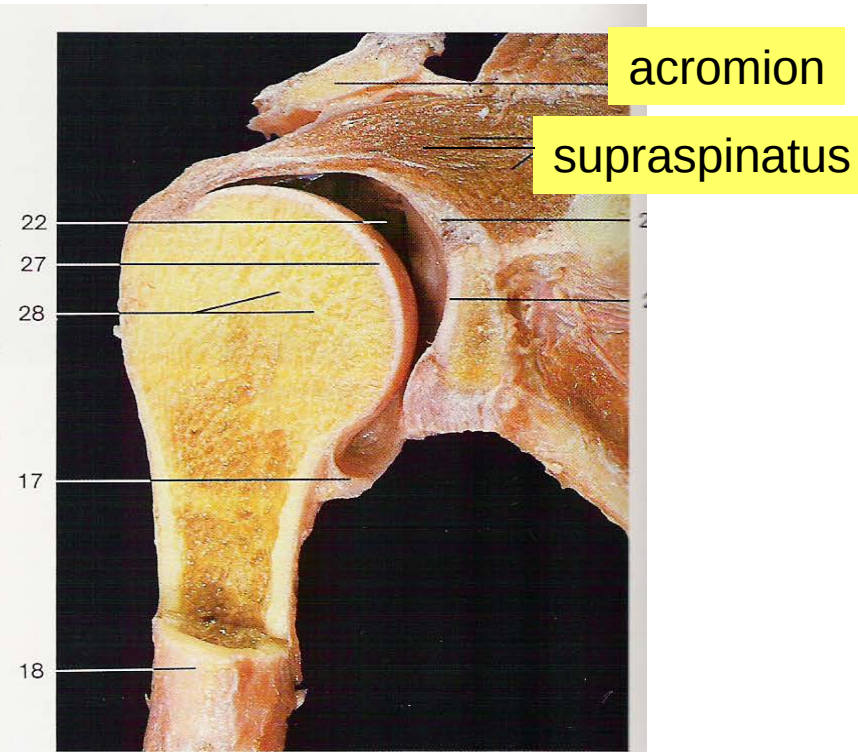
- Nerve entrapment syndromes with pain, paresthesias or weakness.

Shoulder WRMSDs

- Impingement/compression syndrome
 - a compromise of the space between the coracoacromial arch and the proximal humerus.



Right shoulder joint. The anterior part of the articular capsule has been removed and the head of the humerus has been slightly rotated outward to show the cavity of the joint.



Coronal section of the right shoulder joint (anterior aspect).

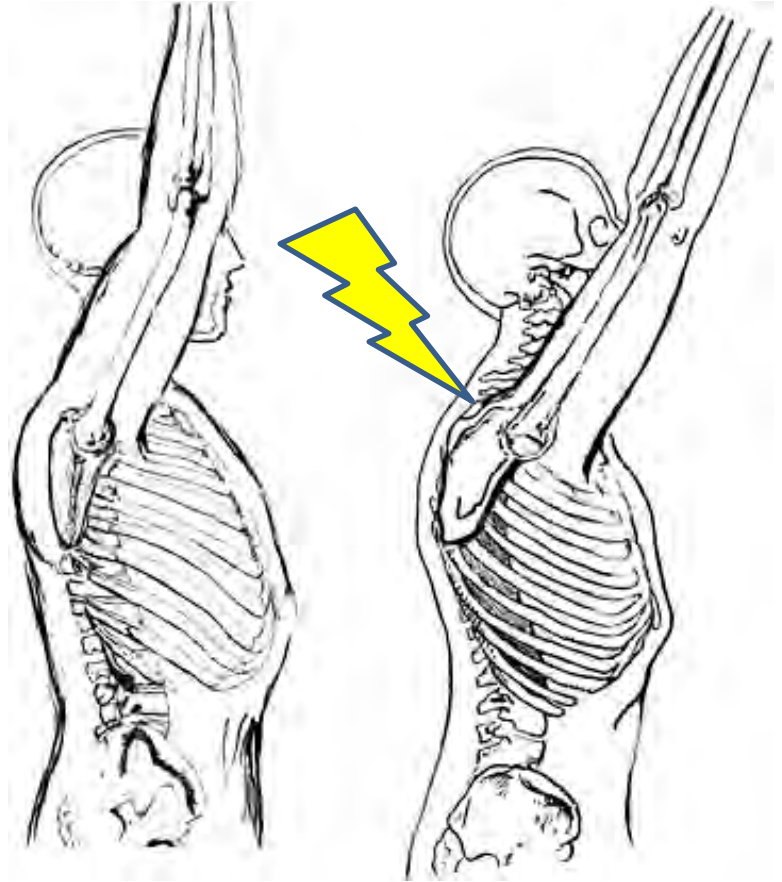
Shoulder MSDs

- Numerous causes
- Typically due to prolonged kyphotic posture with scapula protracted (round shoulders) and humerus frequently held in abduction.



Shoulder

Protracted shoulder and kyphotic posture allows humeral head impingement (compression) on rotator cuff tendons.



Neck Pain, Back Pain and WRMSDs

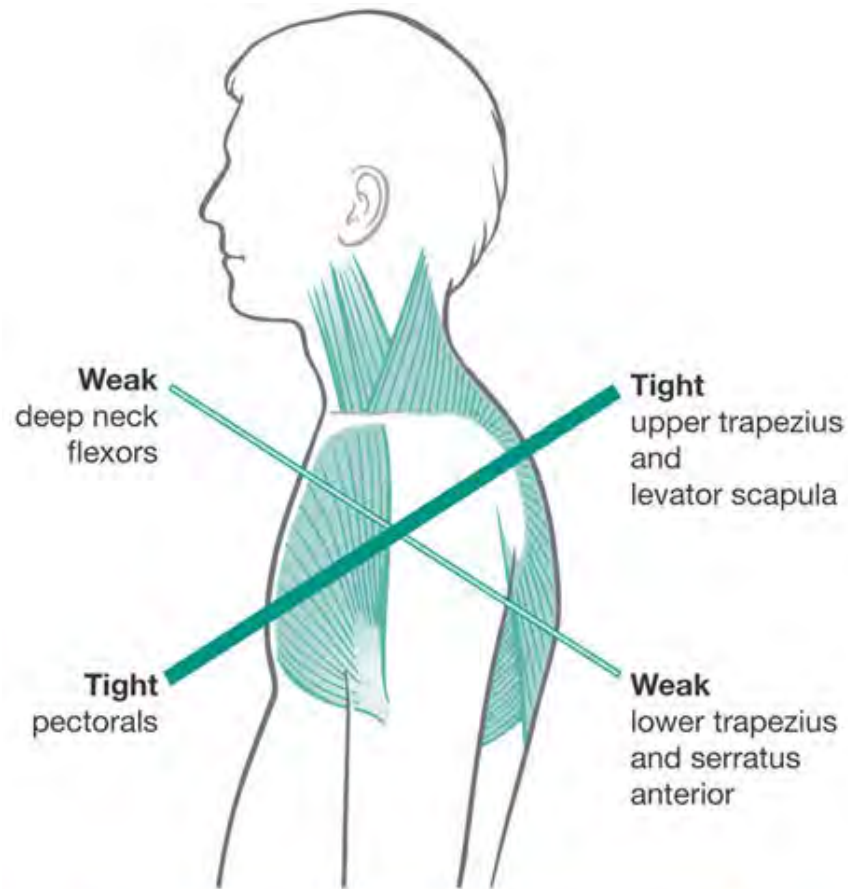
- Often results from prolonged faulty static postures.
- Can have its origins in remote trauma (MVA for example)



Neck Pain

- Frequently the result of the stresses of prolonged head forward posture
- May be associated with shoulder or mid-back pain or headache.
- Radiculopathy may or may not be present.





Upper Crossed Syndrome

Classic muscle imbalance model

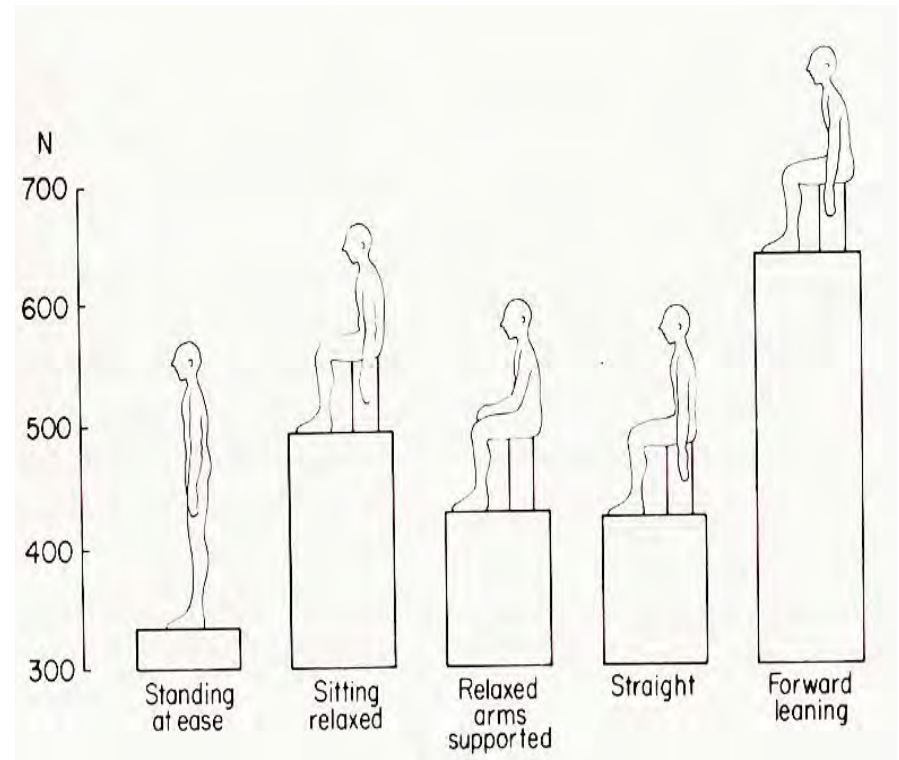
Muscle imbalance leads to joint dysfunction

Neck Pain

- Muscle tension and/or cervicogenic headache is frequently a symptom of cervical spine dysfunction.
- Cervicogenic Headache:
 - Pain tends to be on one side.
 - Moderate to severe pain that usually starts in the neck
 - Episodes of varying duration
 - Fluctuating continuous pain
 - Restriction in neck ROM noted.

Low Back Pain

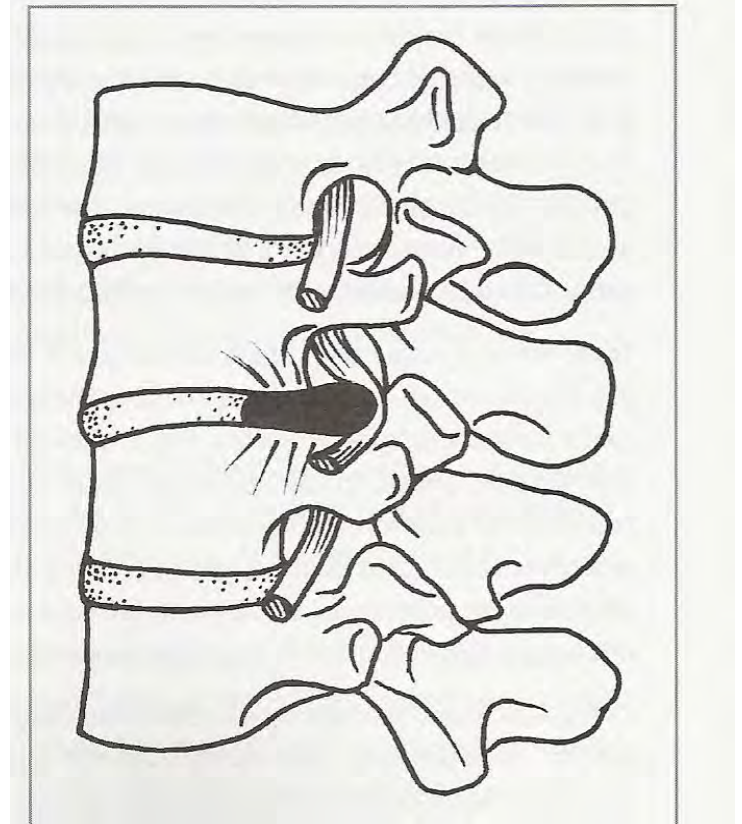
- May from constant pressure/tension loading of muscles and soft tissues during prolonged periods of sitting especially with forward leaning.



Disc Herniation

Herniated lumbar discs

most often occur following excessive loading and poor biomechanics coupled with poor trunk strength and control. Leg pain, leg numbness and weakness are symptoms associated with disc herniation.



Low Back Pain

- May present as chronic, constant pain aggravated by sitting or more commonly as recurrent episodes of acute pain precipitated by seemingly insignificant events.
- Leg pain may be associated.

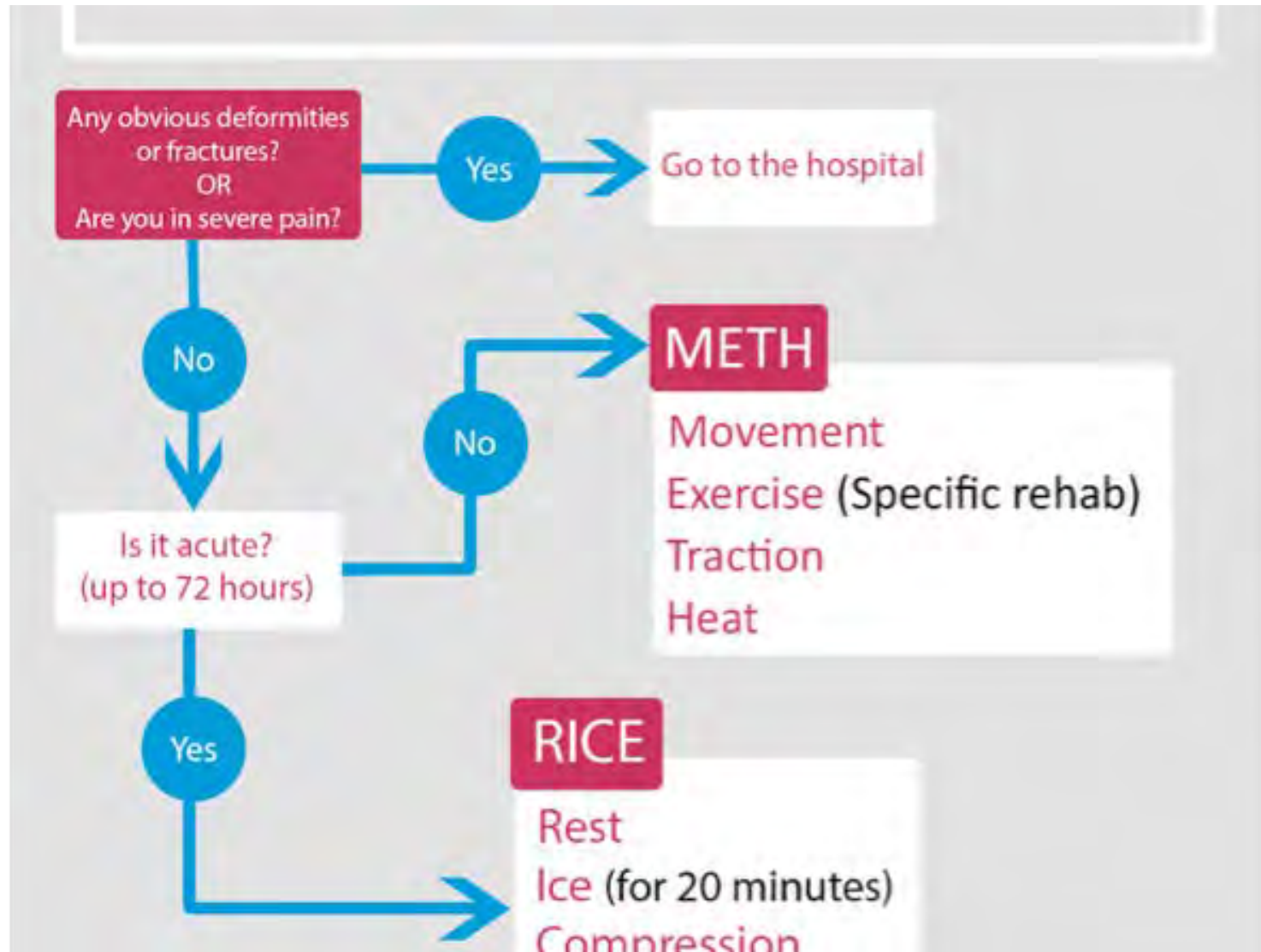


Management

- Treatment
- Prevention
 - Ergonomics
 - Microbreaks
 - Conditioning

Treatment

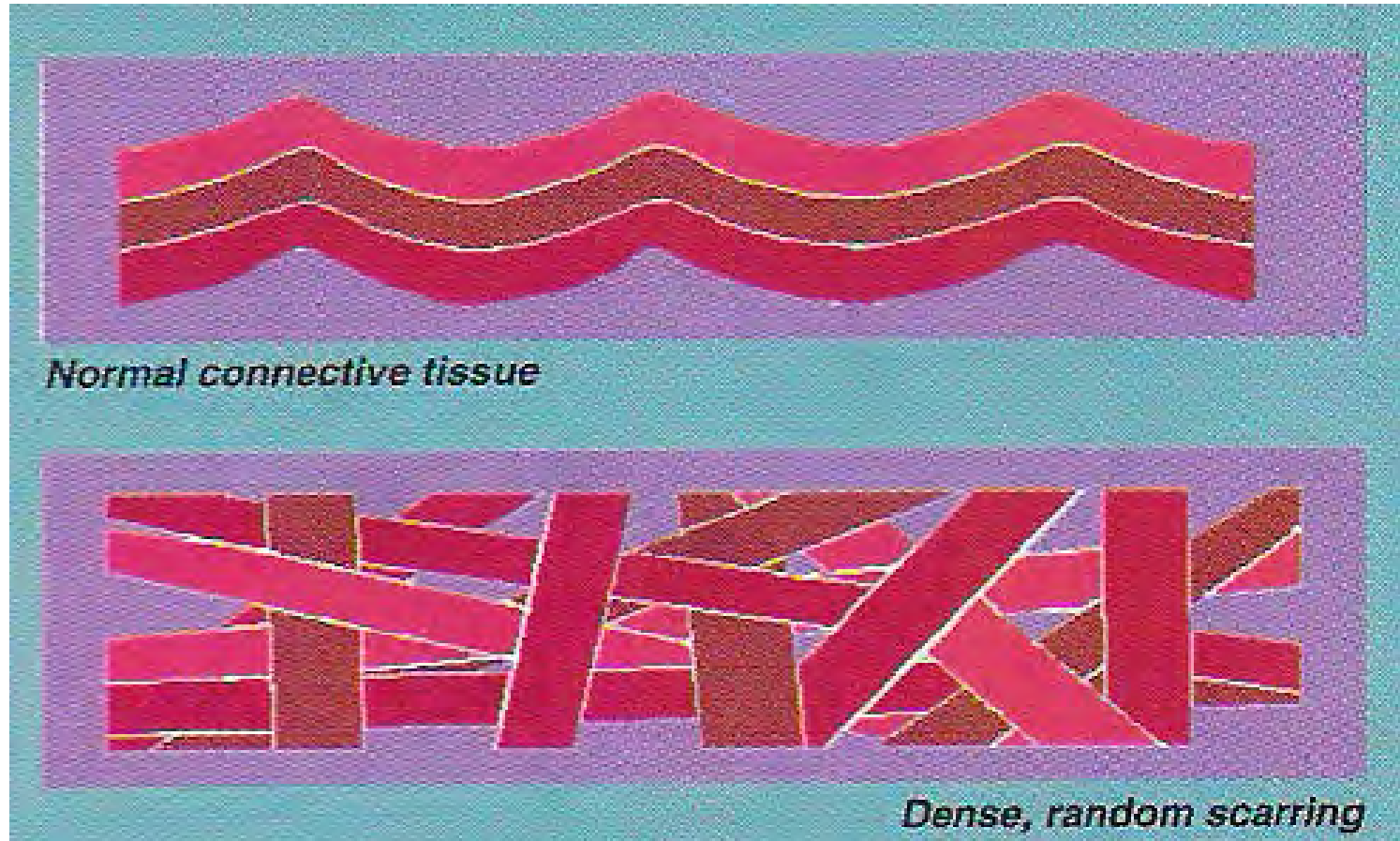
- REST! Suspend, modify or avoid activity that is causing injury
- Medication- short term only, if at all!
- Physical Medicine Modalities
- Rehabilitation



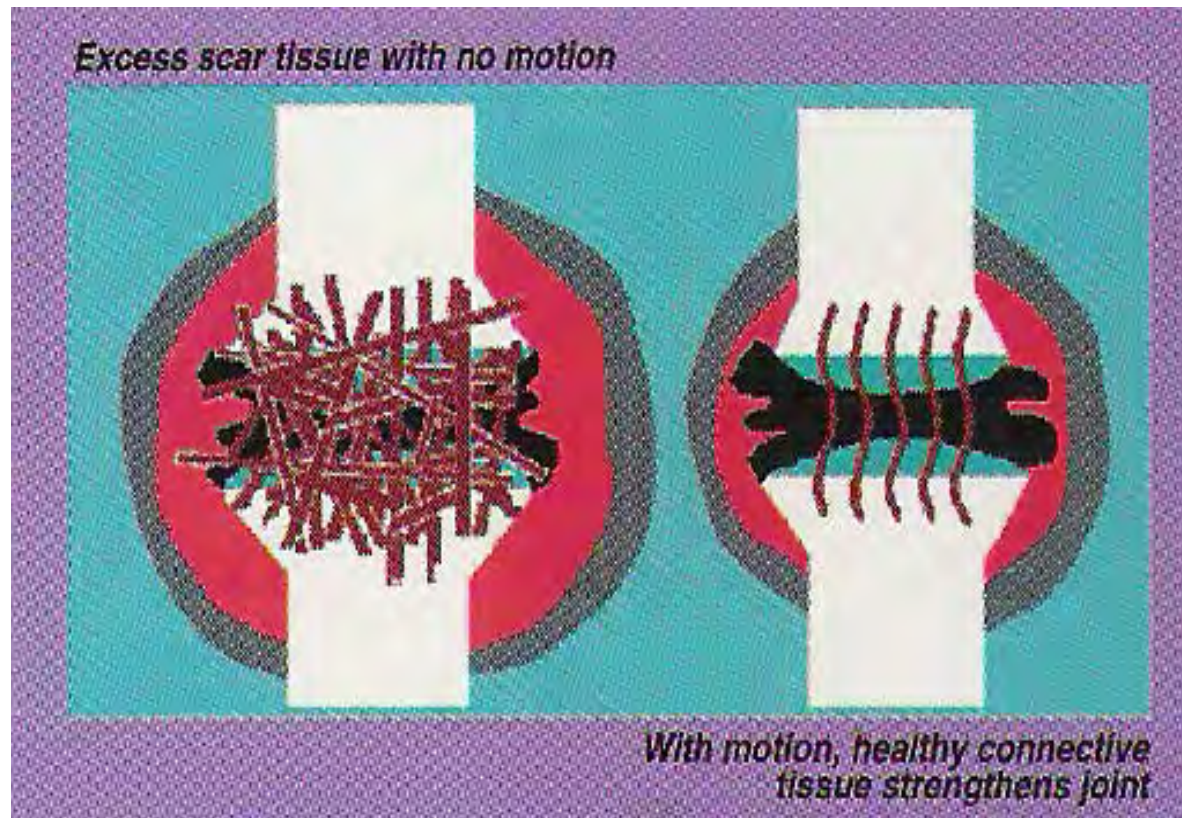
Adapted from Dr. Nikita Vizniak



Effects of immobilization on connective tissue



Effects of immobilization on connective tissue



Medication

- NSAIDS – most commonly prescribed
 - Analgesic, anti-inflammatory
 - May prove counterproductive
 - Side effects

NSAIDS

- NSAIDS block the inflammatory phase of the healing process, a necessary component of tissue repair, and therefore delay healing of musculoskeletal injuries.
- “inflammation can occur without healing but healing cannot occur without inflammation”.
 - Leadbetter WB: An introduction to sports-induced soft-tissue inflammation. Sports-induced inflammation: Clinical and Basic Science Concepts. Park Ridge, IL, American Academy of Orthopedic Surgeons, 1990, p. 13

NSAIDs

- Short Courses (24-48 hours) only for acute tenosynovitis or paratenonitis
- Concerns*
 - Muscle Injuries- Minimal benefit when compared with placebo
 - Ligament Injuries- some studies suggest increased instability and decreased ROM vs. placebo.
 - Tendon injuries- chronic injuries become degenerative not inflammatory. Impeding inflammatory process may cause tendinopathy.

NSAIDS- concerns*

- Dangerous GI side effects- 16,500 deaths per year attributable to GI bleeds from prescribed NSAIDS. 103,000 hospitalizations.
- Renal disease, failure
- Liver disease
- Increased risk of heart attack
 - * Stovits SD, Johnson, RJ NSAIDS and Musculoskeletal treatment. What is the Clinical Evidence? The Physician and Sportsmedicine Vol 31 No. 1 Jan 2003

Corticosteroids

Corticosteroids are catabolic steroids and may weaken the structures to which they are applied.

High risk of relapse and may even lead to a rupture of the tendon

Coombes BK, Bisset L, Vicenzino B (2010) Efficacy and safety of corticosteroid injections and other injections for management of tendinopathy: a systematic review of randomised controlled trials. Lancet 376: 1751-1767



Steroid injections for knee osteoarthritis "doesn't improve pain or function scores, and may increase cartilage breakdown".

McAlindon TE, LaValley MP, Harvey WF, Price LL, Driban JB, Zhang M, Ward RJ. Effect of Intra-articular Triamcinolone vs Saline on Knee Cartilage Volume and Pain in Patients With Knee OsteoarthritisA Randomized Clinical Trial. *JAMA*. 2017;317(19):1967-1975.

Alternatives

- Protect- Short term.
- Ice short term, then heat
- Soft tissue manipulation/mobilization
- Interferential Current
- Bromelain
- Curcumin
- Bioflavonoids
- Isometric > Eccentric > Concentric exercise

Manual Therapy

The term manual therapy is non-specific and refers to techniques that use the hands to diagnose and treat disorders of the musculoskeletal system.

May be performed by chiropractors, physical therapists, osteopathic physicians and others.

-Chiramonte D, D'Adamo C, Morrison B in Practical Management of Pain 5th Edition. Honorio Benzon, ed 2013. Elsevier

Manual Therapy

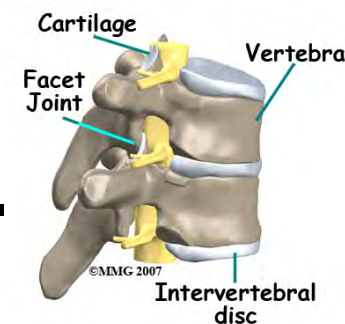


Emerging research reveals that manual therapy is an effective nonpharmacological approach that affects the pain state by

1. decreasing peripheral inflammation and nociception
2. decreasing activation at the spinal cord level
3. activating descending modulation via the brain and central nervous system

Bialosky JE, Bishop MD, Price DD, Robinson ME, George SZ. The mechanisms of manual therapy in the treatment of musculoskeletal pain: a comprehensive model. *Man Ther.* 2009;14(5):531–8. doi: 10.1016/j.math.2008.09.001.

At the joint, muscle, tendon level.



Chiropractic reduces
inflammation, reduces amount
of **pain triggering chemicals**
produced by injured tissues.

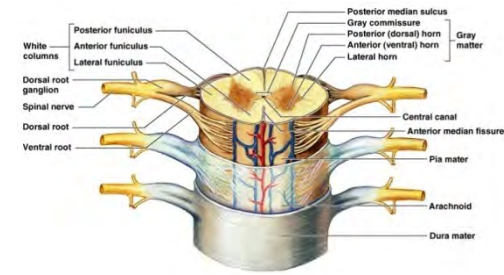
(Teodorczyk-Injeyan et al., 2006, Degenhardt et al., 2007,
McPartland et al., 2005. Smith et al., 1994, Field et al.,
2002)



MORRISON
CHIROPRACTIC, P.A.

Gentle, Effective, Quality Chiropractic Care

Spinal Cord

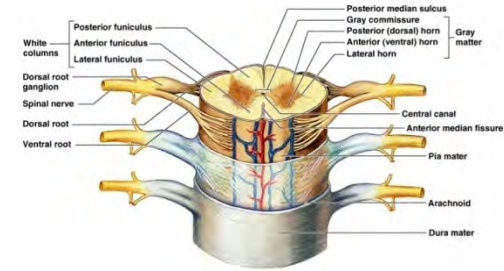


Chiropractic Manipulation:

- Produces HUGE amounts of non-threatening information from nerves to spinal cord and ultimately the brain which inhibits the danger signal



Spinal Cord



Chiropractic Manipulation:

- QUIETS “threatening” nerve messages to spinal cord.



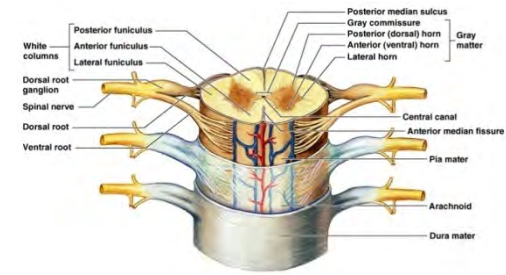
MORRISON
CHIROPRACTIC, P.A.

Gentle, Effective, Quality Chiropractic Care

Spinal Cord

Chiropractic Manipulation:

REDUCTION in muscle spasm



Chiropractic affects the brain



- Decreases activation of the brain regions responsible for producing pain
- Increases naturally produced pain suppressing chemicals- opioids, cannabinoids.



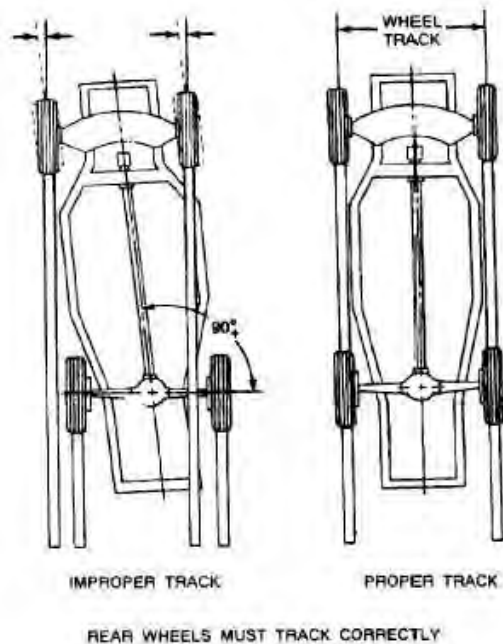
Malisza et al., 2003a; Moulson & Watson, 2006; Sterling et al., 2001; Vicenzino et al., 1998; Delaney et al., 2002; Zhang et al., 2006; Vernon et al, 1986; Kaada & Torsteinbo, 1989.



MORRISON
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Using manipulation to correct joint dysfunction is proposed to relieve abnormal mechanical stress.



“Spinal manipulation acts so rapidly (*and is safest intervention*) in responders that it could be used as a screening tool to help get the right treatment to the right patient at the right time.”



-Interview with researcher, Greg Kawchuk, DC, PhD (*Italics mine*).

Wong A, Phil M, Parent E, Dhillon S, Prasad N, Kawchuk G. Do Participants With Low Back Pain Who Respond to Spinal Manipulative Therapy Differ Biomechanically From Nonresponders, Untreated Controls or Asymptomatic Controls? Spine: 01 September 2015 - Volume 40 - Issue 17 - p 1329–1337

Manipulation/adjustment for appropriately selected MSK patients is at least as effective and significantly safer than NSAIDs and other medications.

Better functional outcomes and higher levels of patient satisfaction.

Russell, I et al. United Kingdom back pain exercise and manipulation (UK BEAM) randomised trial: effectiveness of physical treatments for back pain in primary care BMJ 2004;329(7479):1381 (11 December)

Gaumer, G. Factors Associated With Patient Satisfaction With Chiropractic Care: Survey and Review of the Literature. *J Manipulative Physiol Ther.* 2006; 29: 455–462 .

Rubinstein, SM, Leboeuf-Yde, C, Knol, DL et al, The benefits outweigh the risks for patients undergoing chiropractic care for neck pain: a prospective, multicenter, cohort study. *J Manipulative Physiol Ther.* 2007;30:408–418.

Safety of Chiropractic



The risk for serious side effects is much lower than for other forms of medical treatment, including even simple medication like NSAIDs or Tylenol.



Systematic Review and Meta-analysis of Chiropractic Care and Cervical Artery Dissection: No Evidence for Causation

“There is no convincing evidence to support a causal link between chiropractic manipulation and CAD. Belief in a causal link may have significant negative consequences...”

Church E W, Sieg E P, Zalatimo O, et al. (February 16, 2016) Systematic Review and Meta-analysis of Chiropractic Care and Cervical Artery Dissection: No Evidence for Causation. Cureus 8(2): e498.

Results of a collaborative analysis by the Departments of Neurosurgery at Penn State Hershey Medical Center and Johns Hopkins University School of Medicine

2017 American College of Physicians Guidelines

New guidelines published by the American College of Physicians (ACP) note that most acute low back pain improves over time regardless of treatment; however, ACP recommends that patients who seek relief should first select non-drug treatments such as superficial heat, massage, acupuncture or **spinal manipulation** before turning to pain medications.

#Chiropractic1st



www.acatoday.org

© American Chiropractic Association



Source: Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians, *Annals of Internal Medicine* (2017)

Soft Tissue Manipulation/Mobilization

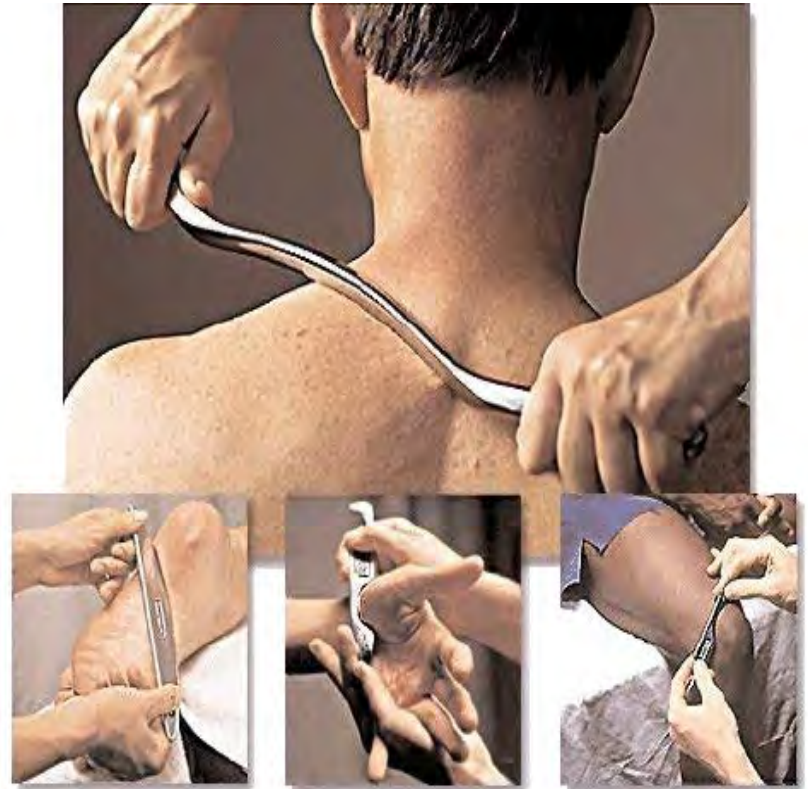
- Active or Myofascial Release
- Post-isometric Relaxation
- Instrument Assisted Soft Tissue Manipulation

Proposed Effects of Tissue Mobilization

- Release of fascial restrictions
- Separates and breaks down collagen cross-links
- Splays and separates connective tissue and muscle fibers
- Increases skin temperature
- Facilitates reflex changes in chronic muscle holding patterns
- Increases rate and amount of blood flow to and from the area
- Increases fibroblast activity
- Facilitates GAG production which maintains interfiber distance
- Restores joint motion

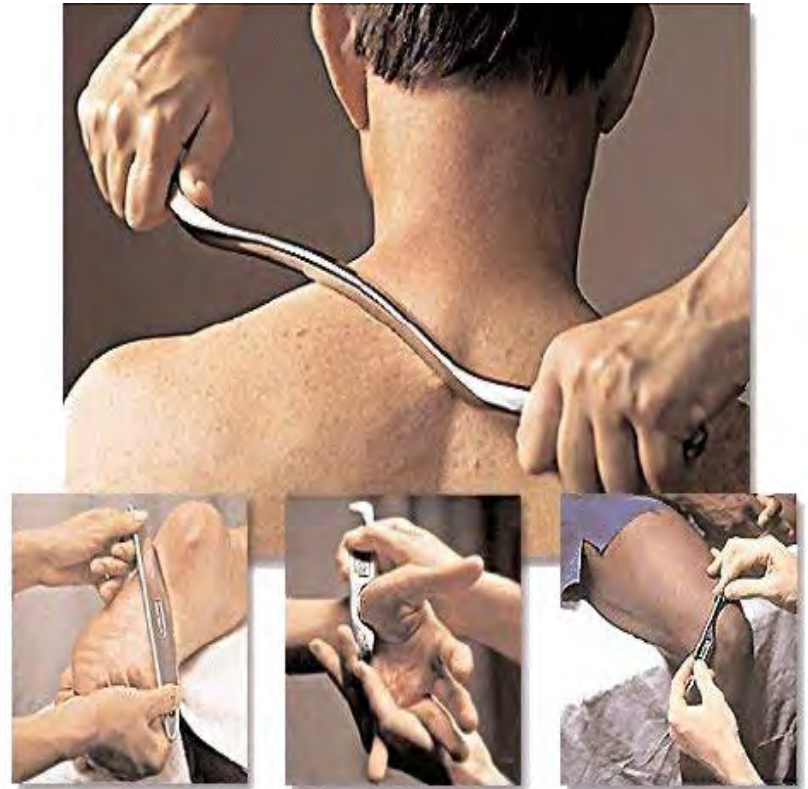
Graston® Technique

- Instrument assisted soft tissue manipulation.
- Proven in clinical trials at Ball Memorial Hospital and Ball State University in Muncie Indiana.
- Used by trainers, PTs and chiropractors.
- Best to avoid using on compression tendinopathies



Graston® Technique

- Patented beveled edge stainless steel instruments
- Benefits:
 - Superior results
 - Interactive
 - Less treatment time: 1 minute per area
 - Fewer treatments: typically 8 sessions
 - Reduced frequency: 2 x per week





Treatment

- **Education-** patient is taught strategies to protect the musculoskeletal system and enhance over-all health during day to day routine

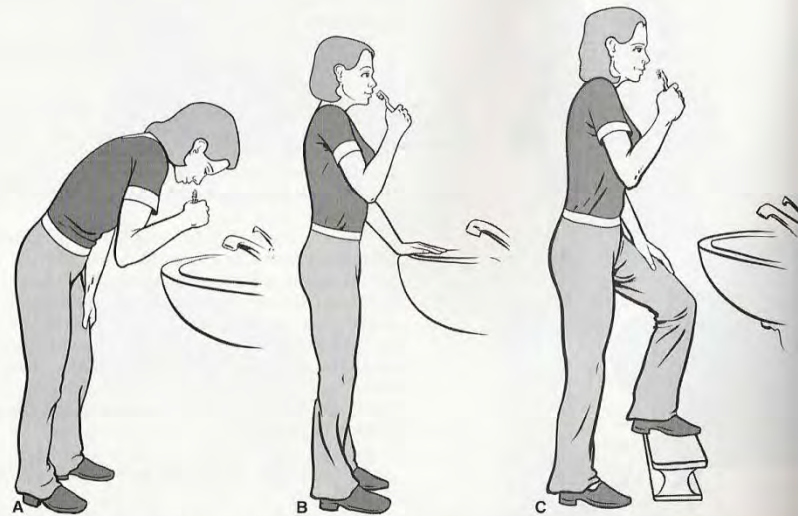
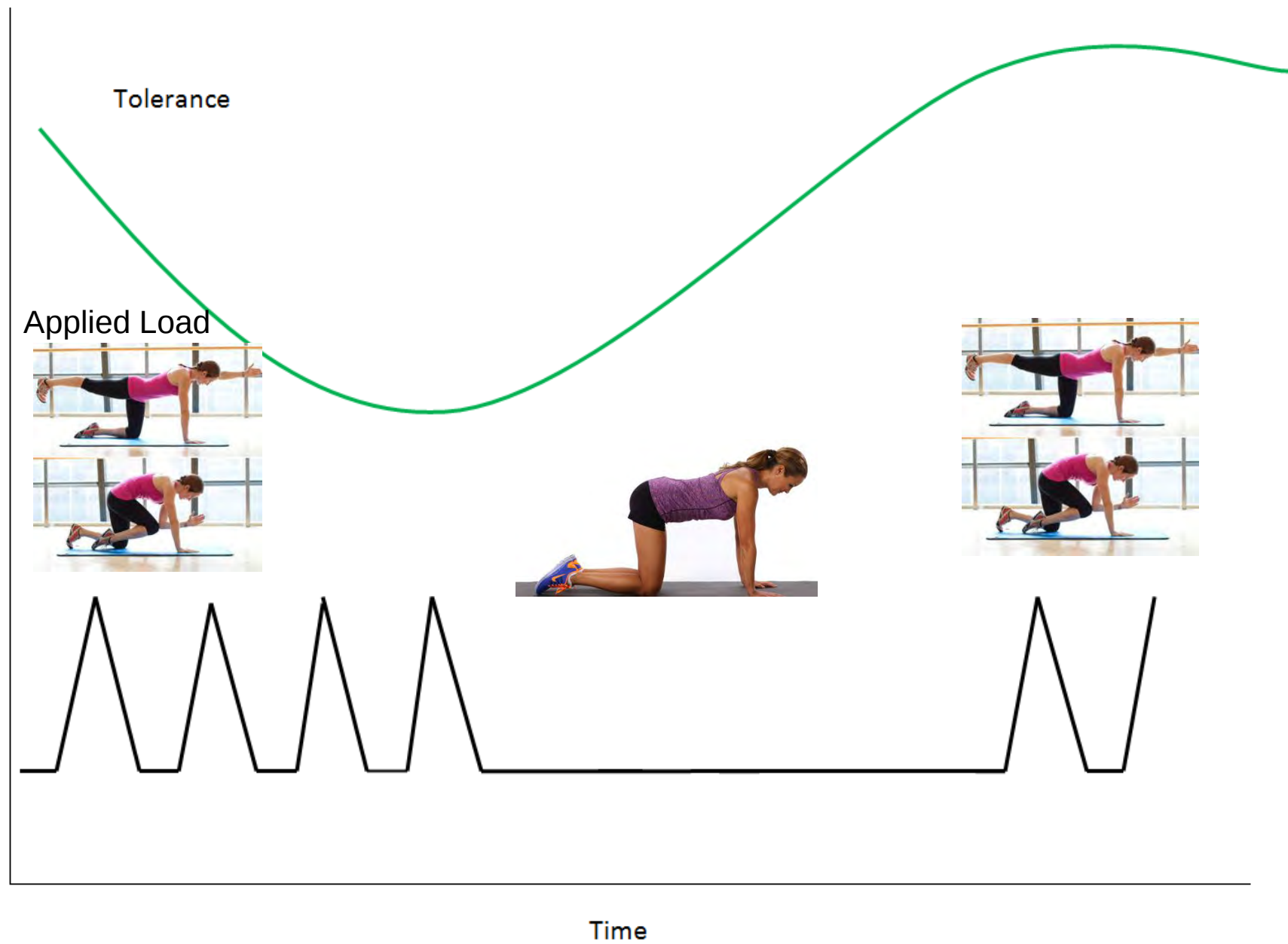


Figure 14.18 Brushing teeth (A) incorrect and (B & C) correct.

Exercise for Pain Control and to Heal

- Adequate time between loading is important to allow a tendon to respond.
- Volume (hours) and frequency (number of sessions per day/week) is likely critical in the capacity of tendons to endure load.

(Cook & Purdam, 2009).



Applying load- Exercise

- Isometric- Pain control, start healing
- Eccentric- Remodel and repair, strengthen
- Concentric- Strengthen, improve performance

How does exercise repair?

- Mechanocoupling—mechanical load turns into biochemical signal
- Gene up-regulation promotes protein synthesis
- Cell-cell communication- signal passed to other cells in tissue.

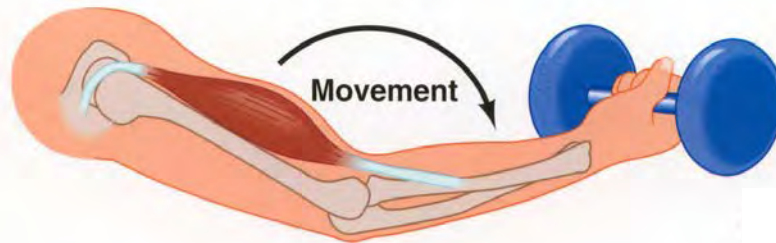
Cook, J., & Purdam, C. R. (2009). Is tendon pathology a continuum? A pathology model to explain the clinical presentation of load-induced tendinopathy. *British journal of sports medicine*, 43(6), 409-416.

Isometric contraction

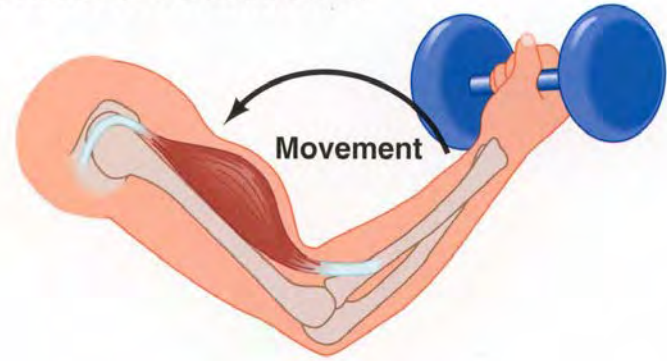
Muscle contracts
but does not shorten



Eccentric contraction



Concentric contraction



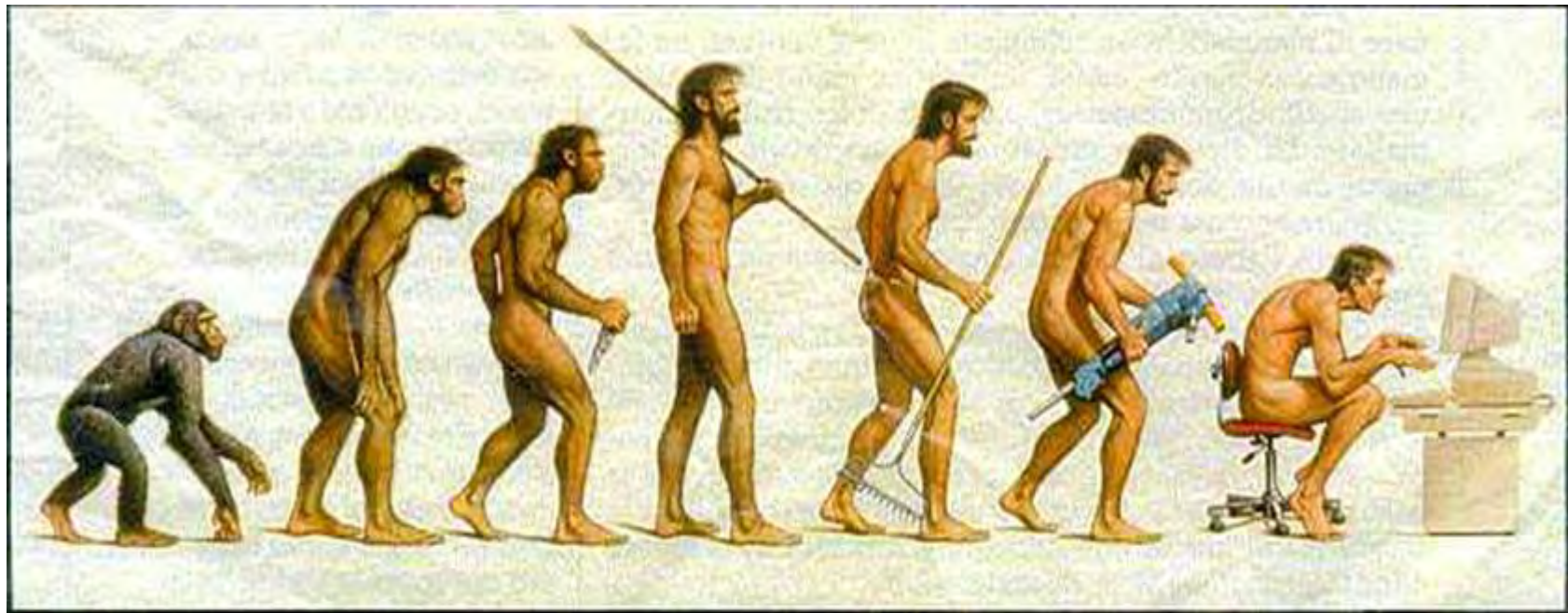
Management

- Prevention
 - Ergonomics
 - Microbreaks
 - Conditioning

Ergonomics

- The study of methods used for the preservation of health and efficiency.
- Includes:
 - The design of the equipment and furniture
 - The arrangement of the work environment
 - The design of job tasks that can be easily and effectively performed by the work place user





[https://www.osha.gov/SLTC/etools/hospital/sonography/
access_patient.html](https://www.osha.gov/SLTC/etools/hospital/sonography/access_patient.html)

**UNITED STATES
DEPARTMENT OF LABOR**

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Emergency

Engineering

Healthcare Wide ▶

Hazards

Medication

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Sonography

Positioning Patients and Equipment


An OSHA Cooperative Program

Home ▶ Transporting ▶ Positioning ▶ Use and Orientation ▶ Engineering and Administrative Controls ▶

A successful sonographic scan depends on getting the transducer into an accurate position on the patient and being able to maintain that position for an appropriate period of time. Being able to accomplish this while protecting the sonographer depends on appropriate placement of the patient in relation to the sonographer. This placement can be highly variable depending on:

- The procedure being performed.
- The size of the patient and the sonographer.
- The type, size and placement of the equipment used.
- The size and layout of the exam room.

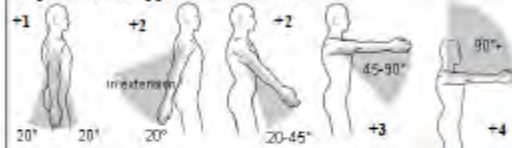
Sonographers must be diligent in positioning all equipment such as exam tables, chairs,

RULA Employee Assessment Worksheet

based on RULA: a survey method for the investigation of work-related upper limb disorders, McAtamney & Corlett, Applied Ergonomics 1993, 24(2), 91-99

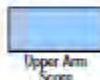
A. Arm and Wrist Analysis

Step 1: Locate Upper Arm Position:



Step 1a: Adjust...

- If shoulder is raised: +1
- If upper arm is abducted: +1
- If arm is supported or person is leaning: -1



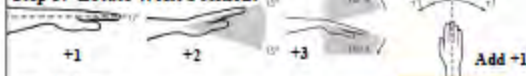
Step 2: Locate Lower Arm Position:



Step 2a: Adjust...

- If either arm is working across midline or out to side of body: Add +1

Step 3: Locate Wrist Position:

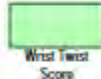


Step 3a: Adjust...

- If wrist is bent from midline: Add +1

Step 4: Wrist Twist:

- If wrist is twisted in mid-range: +1
- If wrist is at or near end of range: +2



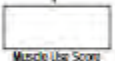
Step 5: Look-up Posture Score in Table A:

Using values from steps 1-4 above, locate score in Table A.



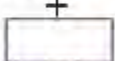
Step 6: Add Muscle Use Score

- If posture mainly static (i.e. held >10 minutes), Or if action repeated occurs 4X per minute: +1



Step 7: Add Force/Load Score

- If load < 4.4 lbs (intermittent): +0
- If load 4.4 to 22 lbs (intermittent): +1
- If load 4.4 to 22 lbs (static or repeated): +2
- If more than 22 lbs or repeated or shocks: +3



Step 8: Find Row in Table C

- Add values from steps 5-7 to obtain Wrist and Arm Score. Find row in Table C.



SCORES

Table A: Wrist Posture Score

Upper Arm	Lower Arm	Wrist Posture Score			
		1	2	3	4
1	1	1	2	2	3
1	2	2	2	2	3
1	3	2	3	3	3
2	1	2	3	3	3
2	2	3	3	3	3
2	3	3	4	4	4
3	1	3	4	4	4
3	2	3	4	4	4
3	3	4	4	4	4
4	1	4	4	4	4
4	2	4	4	4	4
4	3	4	4	4	4
5	1	5	5	5	5
5	2	5	5	5	5
5	3	5	5	5	5
6	1	7	7	7	7
6	2	8	8	8	8
6	3	9	9	9	9

Table C: Neck, trunk and leg score

Wrist and Arm Score	Neck, trunk and leg score						
	1	2	3	4	5	6	7
1	1	2	3	3	4	5	5
2	2	2	3	4	4	5	5
3	3	3	3	4	4	5	5
4	3	3	3	4	4	5	5
5	4	4	4	5	5	6	6
6	4	4	4	5	5	6	6
7	5	5	5	6	6	7	7
8	5	5	5	6	6	7	7

Scoring: (final score from Table C)

- 1 or 2 = acceptable posture
- 3 or 4 = further investigation, change may be needed
- 5 or 6 = further investigation, change soon
- 7 = investigate and implement change

Final Score

B. Neck, Trunk and Leg Analysis

Step 9: Locate Neck Position:



Step 9a: Adjust...

- If neck is twisted: +1
- If neck is side bending: +1

Neck Score

Step 10: Locate Trunk Position:



Step 10a: Adjust...

- If trunk is twisted: +1
- If trunk is side bending: +1

Trunk Score

Step 11: Legs:

- If legs and feet are supported: +1
- If not: +2

Leg Score

Neck Posture Score	Table B: Trunk Posture Score											
	Legs			Legs			Legs			Legs		
1	1	2	3	1	2	3	1	2	3	1	2	3
2	2	3	4	2	3	4	2	3	4	2	3	4
3	3	4	5	3	4	5	3	4	5	3	4	5
4	4	5	6	4	5	6	4	5	6	4	5	6
5	5	6	7	5	6	7	5	6	7	5	6	7
6	6	7	8	6	7	8	6	7	8	6	7	8

Step 12: Look-up Posture Score in Table B:

- Using values from steps 9-11 above, locate score in Table B.

Posture Score B

Step 13: Add Muscle Use Score

- If posture mainly static (i.e. held >10 minutes), Or if action repeated occurs 4X per minute: +1

Muscle Use Score

Step 14: Add Force/Load Score

- If load < 4.4 lbs (intermittent): +0
- If load 4.4 to 22 lbs (intermittent): +1
- If load 4.4 to 22 lbs (static or repeated): +2
- If more than 22 lbs or repeated or shocks: +3

Force/Load Score

Step 15: Find Column in Table C

- Add values from steps 12-14 to obtain Neck, Trunk and Leg Score. Find Column in Table C.

Neck, Trunk & Leg Score

Task name: _____ Reviewer: _____ Date: _____/_____/_____

provided by Practical Ergonomics

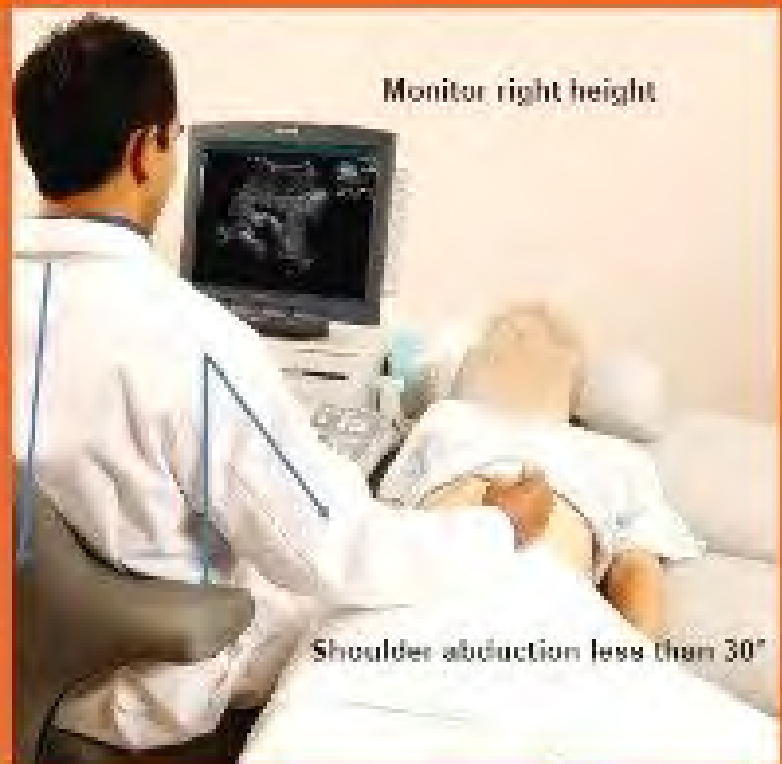
This tool is provided without warranty. The author has provided this tool as a simple means for applying the concepts provided in RULA.

© 2004 Noose Consulting, Inc.

rtarker@ergosmart.com (816) 444-1667

- Seating
- Mouse
- Computer/Equipment arrangement
- Transducer

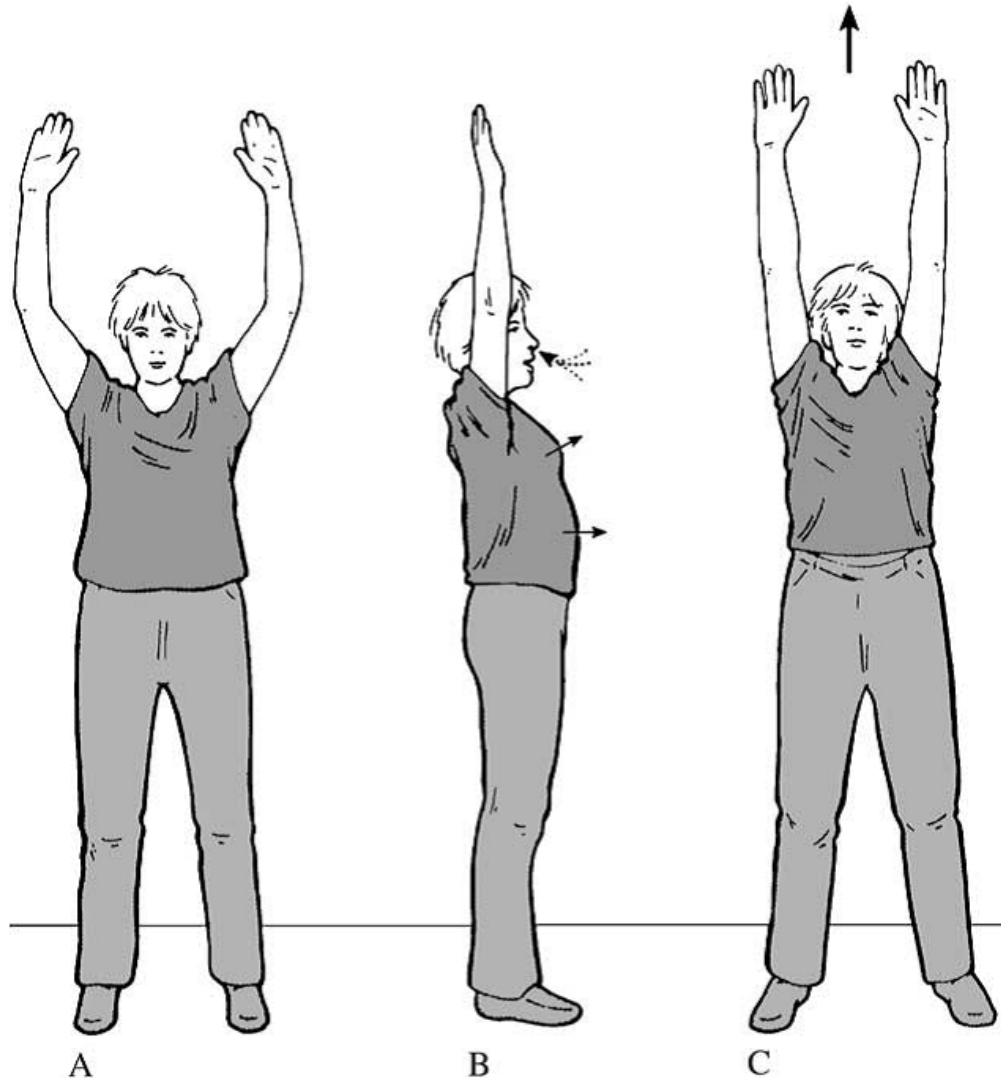




Microbreaks

- Frequent rest periods to reduce effect of repetitive motion and constant pressure/tension.
- Task variation.

Microbreaks



Brugger Break!



Nerve glides



Stretch it out!

Hold each stretch for 15-30 seconds

Regular stretching can help to improve blood flow and reduce muscle tension and risk of injury. Perform each stretch slowly and without bouncing. If you feel abnormal discomfort, stop the stretch and consult your physician before continuing with a stretching program.



Neck



Lower Back



Chest



Upper Back



Forearm & Wrist



Back of Thigh



Shoulder



Sidebend



Calf



Triceps



Occupational Health & Safety Agency for Healthcare in BC (OHSAH)
#201-1192 W. Broadway/Vancouver BC, V6H 2V5
Tel: 778.208.8000 | Fax: 778.208.8001 | Web: www.ohsah.bc.ca

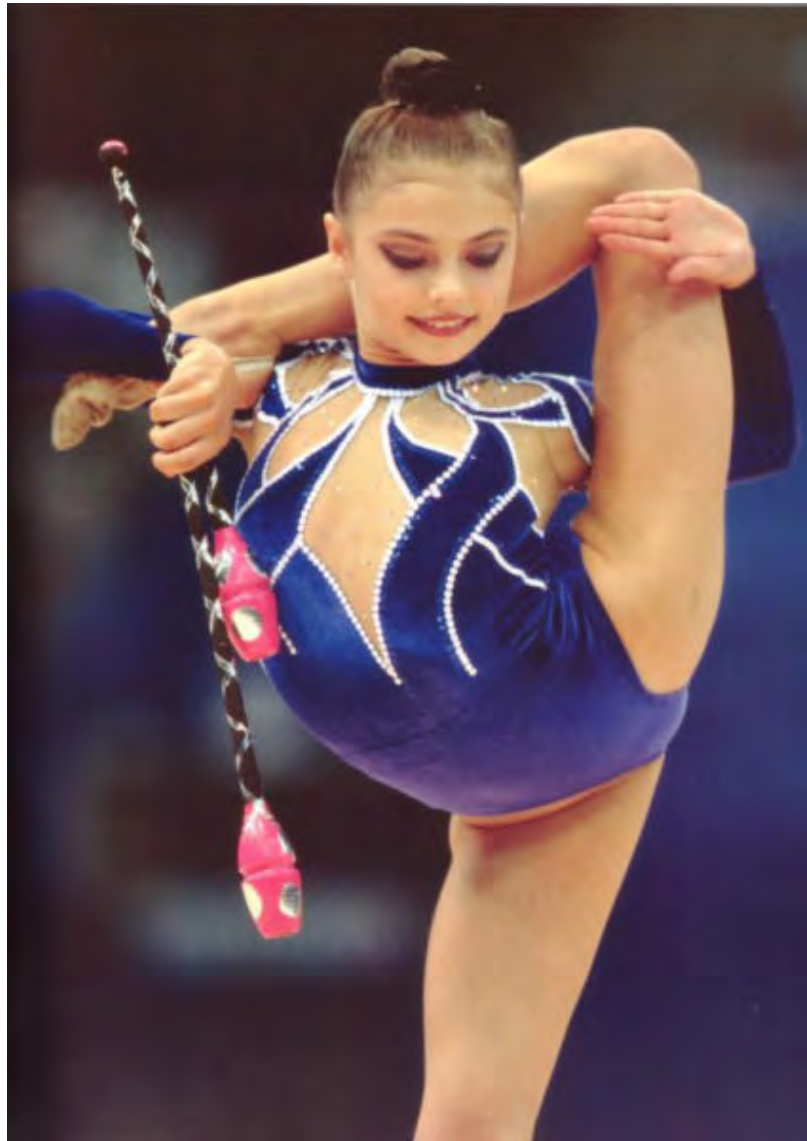
Stretching Considerations

- Static stretching training studies show an increase in range of motion due to an increase in stretch tolerance, not extensibility.
- Static immediately prior to exercise has been shown detrimental to dynamometer-measured muscle and performance in running and jumping.

Ben M, Harvey LA. Regular stretch does not increase muscle extensibility: a randomized controlled trial. *Scandinavian journal of medicine & science in sports*. Feb 2010;20(1):136–144



Excessive
ROM can
lead to
instability,
poor control
and injury



Flexibility and Mobility in Sport

Elite athletes have pretty average flexibility but exceptional levels of strength, power, endurance or balance.

Complete mastery over normal or average ranges of motion.



Mobility, Control, Stability, Accuracy

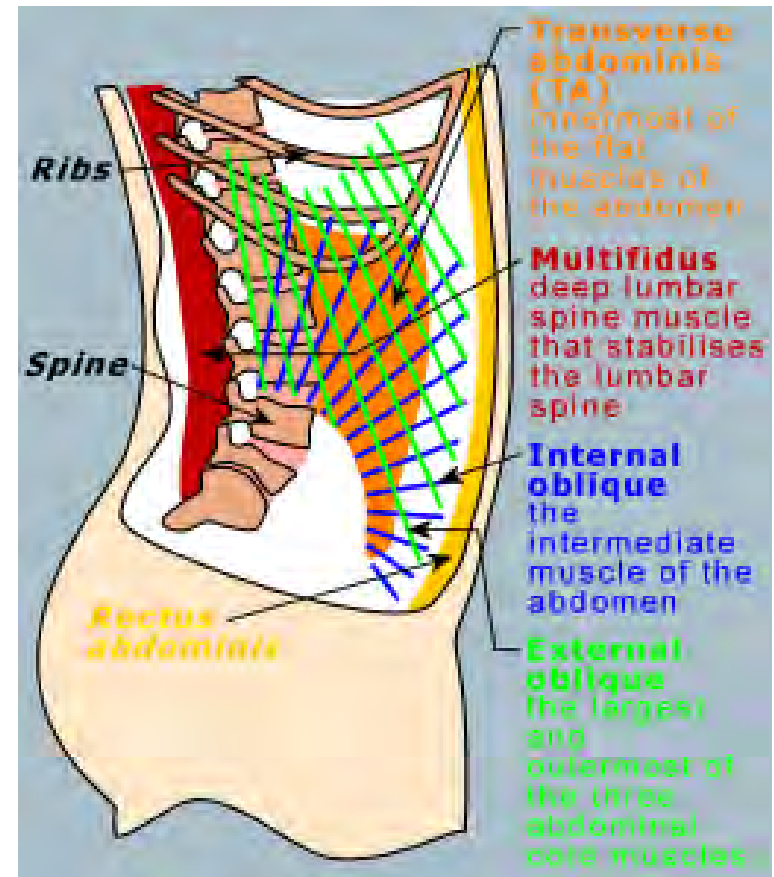
- Joints can move in many directions.
- Combinations are almost infinite- many are not useful and are unsafe.
- **Control = Stability = Ability to prevent unwanted motion.**
- Accuracy is increased

“You can’t shoot a cannon out of a canoe”



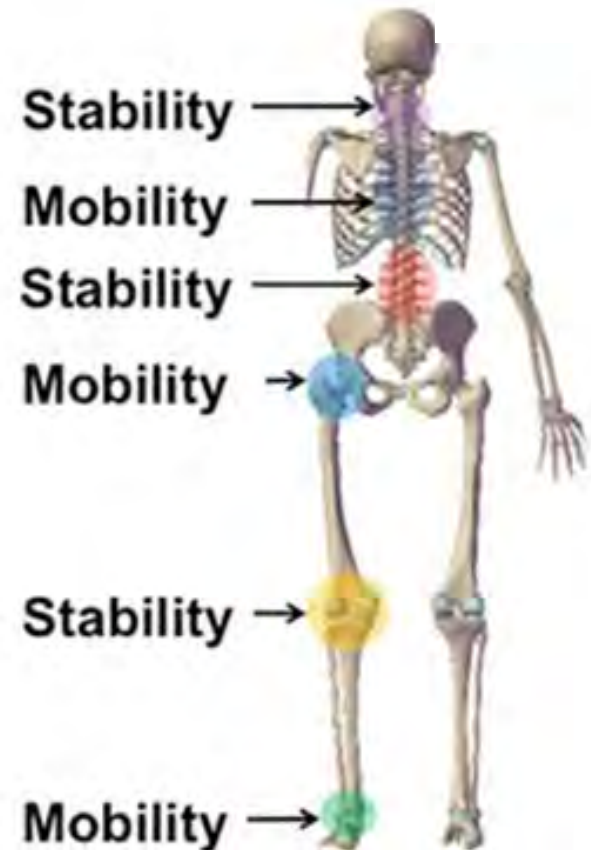
Proximal Stability Allows Distal Mobility

Special spinal and abdominal muscles work together in a coordinated fashion to provide the bulk of required stabilization.



Movement Quality

Painless tissue or joint mobility dysfunctions may cause pain in remote body regions.....



Exercises to reduce musculoskeletal discomfort for people doing a range of static and repetitive work

Christine Leah
Health and Safety Laboratory
Harpur Hill
Buxton
Derbyshire
SK17 9JN

www.hse.gov.uk/research/rrpdf/rr743.pdf

Prevention involves self-care.

- This is something over which the individual worker has control.
- Adequate rest, weight control and exercise all contribute to muscle & joint health.
- Many of our daily activities make significant demand on our muscles, yet we don't warm them up and get them ready for the work they are expected to perform.



Conditioning and Self Care

- Cardiovascular
- Strength
- Flexibility/Mobility
- Pre-task warm-up



Self Care

Warm-up before you work.

- Take a brisk walk, perform shoulder, arm, hand, back exercises to improve circulation to soft-tissues.
- Move well, move often to maintain tissue mobility/flexibility.

Self care

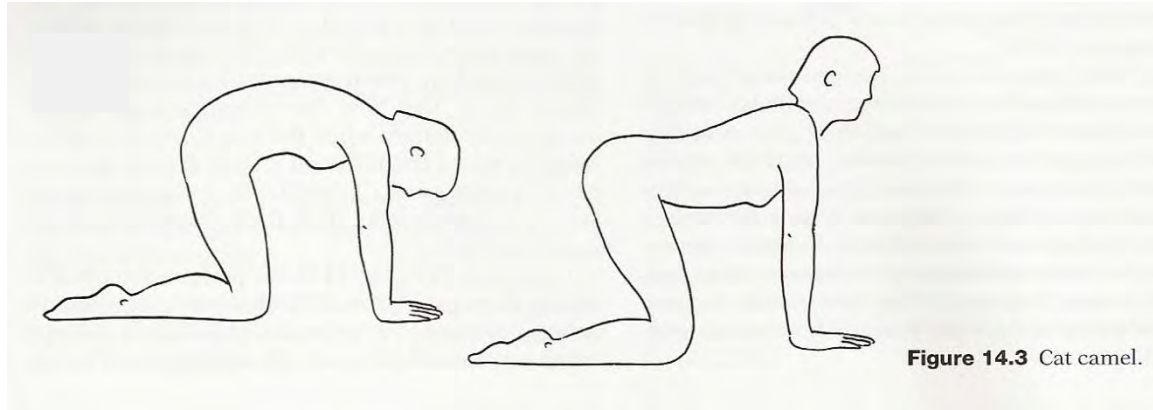


Figure 14.3 Cat camel.

- **Re-activation-** painless movements that unload spinal tissues.

Self Care

- **SELF MASSAGE** (one minute)
- Allow your arm to relax, palm upwards on a firm surface. Using a tennis ball and your other hand, gently massage the tendons through the forearm and wrist in a circular motion along the length of the arm. Keep everything relaxed, especially both your hands and shoulders. If necessary, turn the forearm over and massage the top of the arm too.



Self Care

- **FOLDING FINGERS** (8 seconds each)
- Lay your forearms on the table in front of you, palms together pointing upwards. Take a pair of fingers and cross them. Hold for a few seconds, cross them the other way and hold for a few seconds. Repeat with each pair of fingers. All other fingers not being crossed should remain straight, pointing upwards and together. If this is too hard with forearms flat on the surface, you can bring your hands off the table slightly, elbows remaining, to relieve the posture. Shoulders are relaxed. Over time your mobility should improve to where you can leave your forearms on the table.



Everything Your Gym Teacher Taught You Is Wrong

There Are Safer Ways to Stretch and Do Calisthenics, Say Today's Fitness Pros—Well, Most of Them

By BUZZ McCLAIN

Special to The Washington Post

Thirty-three years ago, at Edison High in Alexandria, we started each period of phys ed with a warm-up. To my mind, it was a waste of time: After the tedium of algebra class (Part 1, and I had to take it twice) I wanted jump right into the volleyball game. But there was a tincture of virtue wafting over the gym: Stretching was good for you, we were told. And so we did it.

Dressed in our high-top Chuck Taylors and bright red cotton sweats, we—boys only, the girls were in the “girls’ gym”—were arranged in rows across the basketball floor with one of the season’s first-string athletes out in front leading us through the warm-up drill. We did deep knee bends, push-ups and jumping jacks, then sat on the floor doing “butterflies” (feet crossed at the ankles and the knees pushed to the floor) and hurdler stretches.

Thusly stretched, we were permitted to partake of the game of the day.

Flash forward from 1969 to 2002. I’m at rugby practice, standing in a wide circle of players. The stretchmeister has us bent at the waist, touching our toes with quick repetitive motions, bouncing at the hips for a full 30 seconds. We do the same with our legs crossed as we stand, and then we drop to the field for butterflies and hurdler stretches.



LIBRARY OF CONGRESS

Just because you were taught to do exercises a certain way long ago doesn't make it right today.

For more than 30 years now, I’ve done these same stretches. And only now I am learning that, like whole milk, something I once thought was good for me is not.

“It’s not what you learned was wrong,” says Judith C. Young, executive director of the National Association for Sport and Physical Edu-

cation (NASPE) in Reston, trying to put a for-giving spin on the bad news. “It’s just out-of-date.”

What’s changed over the past 30 years is physiologists’ understanding of the human body and what the common forms of stretching and calisthenics have been doing to it.

Many of the standards—sit-ups, toe touches, knee bends, hurdler’s stretch and more—have been modified or replaced to reduce the stress they place on vulnerable joints and muscles.

“As the fields of exercise physiology and biomechanics have matured, we’ve become much more knowledgeable in the potential risks associated with certain exercises,” says Cedric Bryant, chief exercise physiologist at the American Council on Exercise in San Diego. “Years ago, you didn’t have MRI techniques, electromyographic studies and ways to measure impact forces. All those advances have allowed us to become more knowledgeable about stresses and loads to various joints in various exercises.”

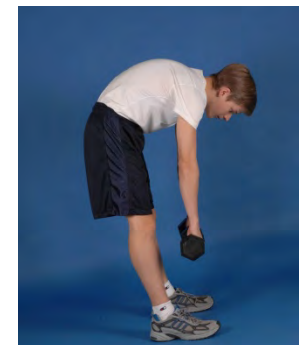
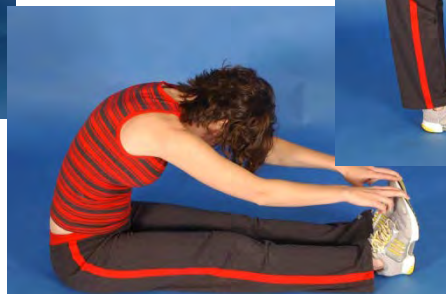
Unfortunately, there are plenty of volunteer coaches and amateur athletes who aren’t getting the message. Either out of habit or ignorance, they’re still inculcating bad habits—and old-school ways.

Even some big guns remain defiant.

“If you never take your knees past 90 degrees, you’ll have the stiffest knees you’ve ever seen,” says Bob Anderson, who literally wrote the book on stretching [see “Old-School Icon Says: Just Do It”]. “Head circles? Yeah, I guess it compresses [the cervical spine] but sitting on you’re a** all day com-

See STRETCH, Page F4

Risky Business



Worth noting...

Don't



Do

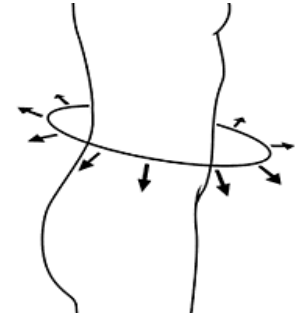
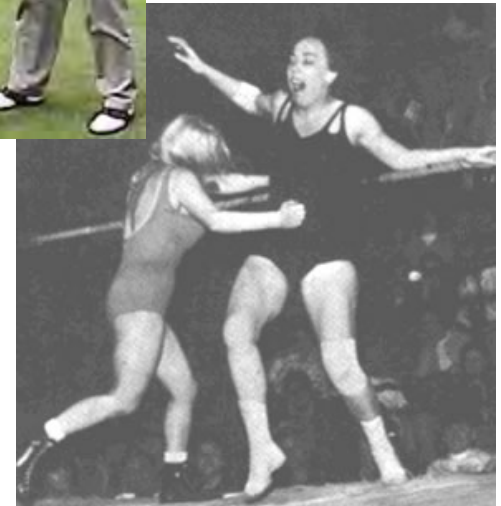
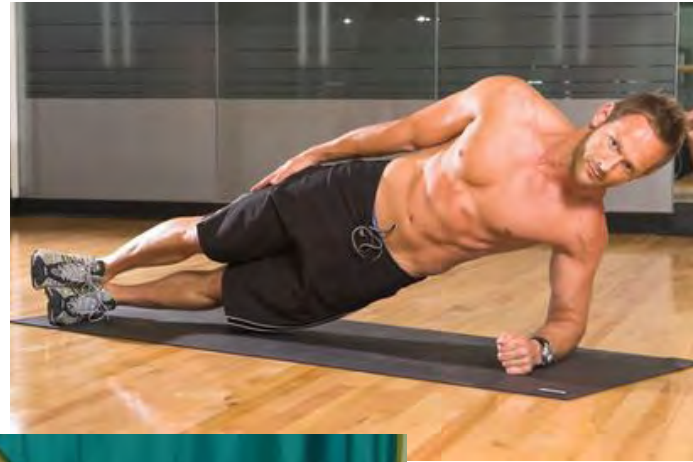


Fig. 3 The abdominal brace.



Some safe exercises





Ellicott City: 2850 N. Ridge Road, Ellicott City, MD 21043 PH: 410.4665.0555
Clarksville: 6565 Ten Oaks Road, Clarksville, MD 21029 PH: 410.531.9985

Plank: While lying on stomach squeeze glutes and brace your core. Keep elbows close to your body and under shoulders. Lift up onto toes and elbows, keeping neutral spine and neck.



Modified Side Bridge: Lay on your side propped up on elbow, arm at 90 degrees. Align elbow and knees. Squeeze glutes and brace core while coming up on your knees and elbow, then push hips forward to create a straight line.





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Bruggers: Stand with legs slightly wider than shoulders, tuck chin, hang arms down by side with palms forward, bring shoulder blades together slightly and extend fingertips.



Curl Ups: Lie on your back, bend one leg and leave the other straight and flat. Place palms under arch of back. Slowly raise chest, shoulders, and head off floor. Briefly hold.





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Bird Dog: From table position, maintain ab brace. Squeeze glutes, reach opposite arm/leg (flexed foot) away from your body. Return hand and knee to tap together then extend back out. Maintain brace and parallel hips.



Glute Bridge: From hook lying position, maintain ab brace to keep spine stable. Spread fingers and push into the mat while raising your pelvis off the floor. Squeeze glute muscles at the top of bridge position.





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Lateral Band Walk: Place band around ankles, slightly bend knees and brace core. Take small lateral steps without rotating the body.



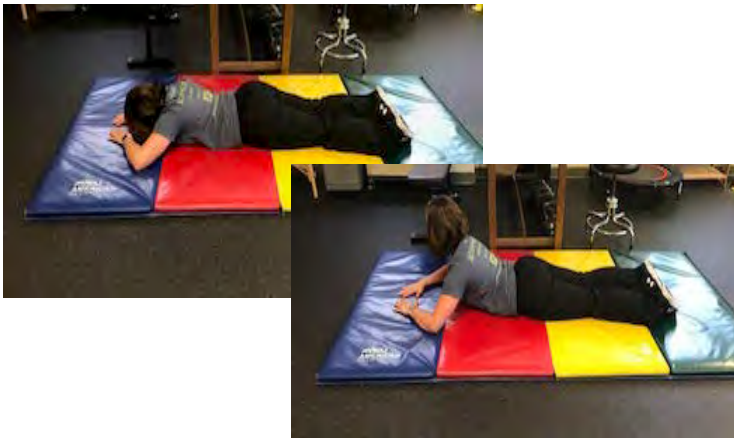
Flossing: Sit in a chair or on a table. Straighten the leg suffering and look up to the ceiling. Lower leg and tuck chin to chest.





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Prone DNS Extension: Lie flat facing down on the floor. Place hands overhead, lining elbows up with ears. Lift off of the mat while pushing through elbows and keeping a neutral neck and spine.



Hamstring Curl: Begin on the floor laying on your back with heels on Valslides. Bend knees 90 degrees and raise hips up so they are in line between knees and shoulders. Slide heels forward until your legs are straight, but don't let hips touch the ground.





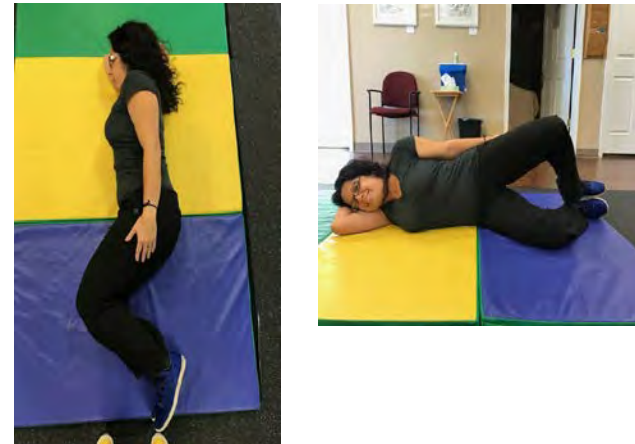
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Isodynamic Shoulder Walk Outs: Keeping elbow close to body, hold abdominal brace and pack shoulders. Keep body tall and facing forward as you step laterally three paces. Avoid hip rotation.



Clams: While laying on the floor align body straight with arm under head. Bending knees making sure feet are behind and aligned with glutes and back. While keeping your feet together, open and close your knees while bracing and squeezing glute muscles. Keep hips stacked.



Avoid “Circus Trick” exercises!



Return to work, sport

Full symptomatic recovery does not ensure full recovery of function. Patients should be advised that, even though the symptoms have subsided, they may not have fully recovered from the injury.

Consult your provider!



Silbernagle K, Crossley, K A Proposed Return-to-Sport Program for Patients With Midportion Achilles Tendinopathy: Rationale and Implementation. journal of orthopaedic & sports physical therapy november 2015 | volume 45 | number 11

What can I expect in terms of improvement?

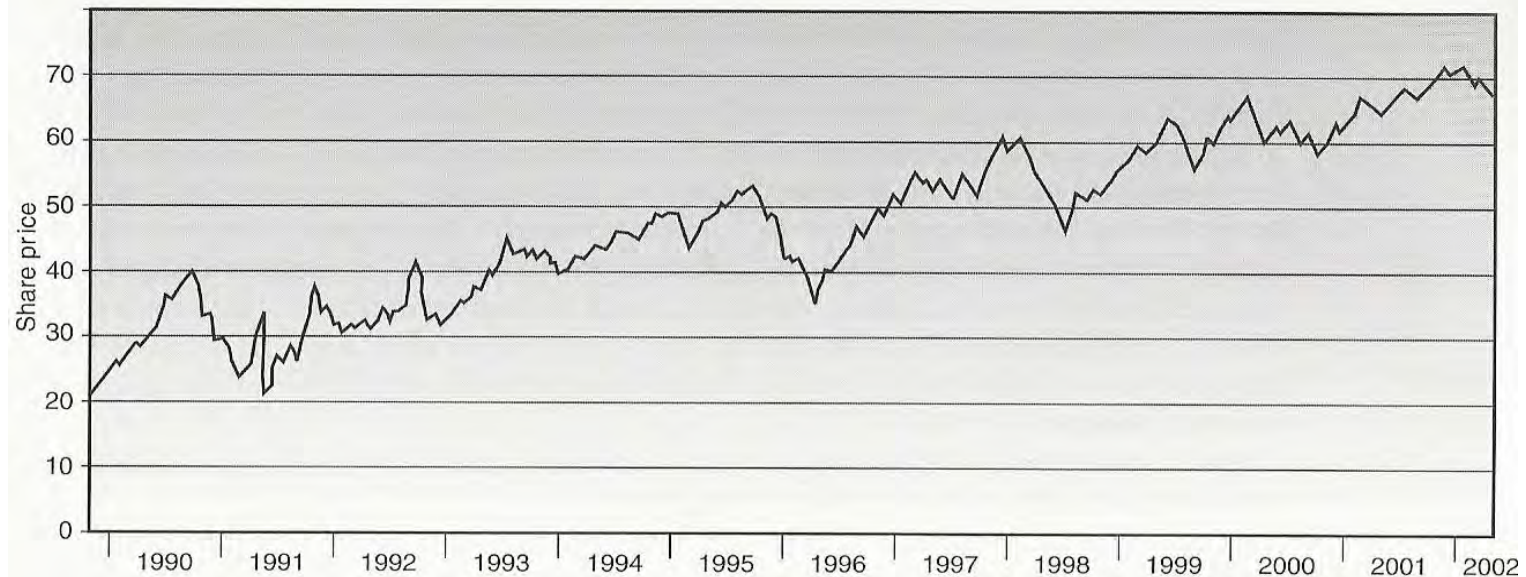
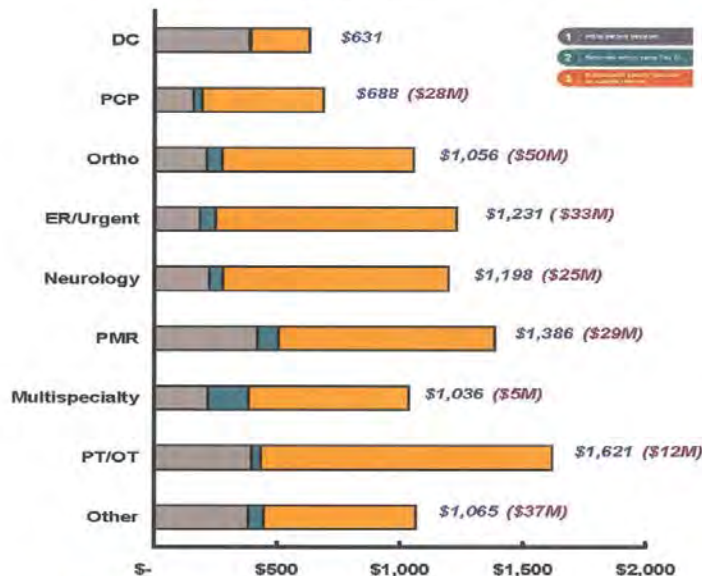


Figure 11.1 The positive slope. The establishment of improvement in back symptoms is often similar to the movement of high-performing stocks on the stock market. While stocks form a noisy signal with their short-term fluctuations, mimicking the day-to-day variations in back symptoms, the average progress over the longer duration has a positive slope. Rehabilitation challenges should never be increased unless a “positive slope” has been established for symptoms and function.

Cost By Entry Point

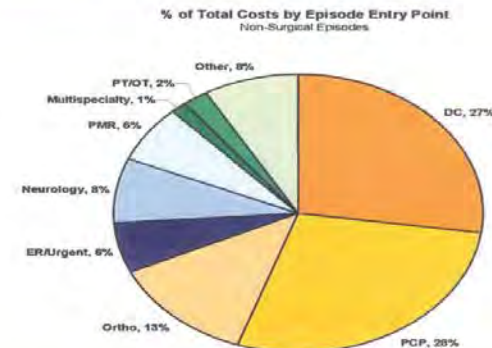
Risk Adjusted Total Episode Cost By Entry Point
1.4 Million Non-Surgical Episodes



Source: OptumHealth Episode Treatment Group Analysis, 2010

Learning Objectives and Questions

- Episode entry point appears to be associated with variable care pathway and costs
- Using DC as a proxy for appropriate non-surgical pathway potential **\$219M** risk adjusted impact for non-surgical spine care for 1.4M episodes in 4M members over 2.5 years



Episode Experience									
Spec	Age	Female	Risk	Duration	Providers	Surgery	Radiology	Pharma	
DC	40	55%	1.8	102	1.8	0%	25%	14%	
PCP	42	56%	2.0	61	2.1	0%	37%	37%	
Ortho/Sports	41	56%	2.5	81	2.6	0%	80%	31%	
ER/Urgent	37	55%	2.1	51	3.2	0%	47%	33%	
Neurology	47	58%	3.5	114	3.3	0%	60%	38%	
PMR	45	57%	2.9	120	3.0	0%	59%	40%	
Multispecialty	42	57%	2.4	76	2.8	0%	48%	33%	
PT/OT	45	63%	2.9	152	4.1	0%	54%	43%	
Other	32	58%	2.2	69	2.4	0%	40%	24%	
Total	41	58%	2.1	84	2.1	0%	38%	28%	

Conclusion: After the complete analysis was conducted, the general consensus showed focus should be given to the portal of entry for these conditions. There were too many minor procedures performed with little to no impact on the patient outcome based on the standard of spinal care. **Conservative management needs to be increased and conditions of this nature should be managed by a chiropractor.** The patient outcomes and estimated dollar savings were overwhelming evidence of this result.

References

1. Jakes C. Sonographers and occupational overuse syndrome: Cause, effect, and solutions. J Diagnostic Med Sonography 2001; 17: 74.
2. 2 Mason B, Robinson C, Brinsmead S, Hassall L, Chamberlin S. The 2014 ASA workplace health and safety survey results. Soundeffects News 2014; 3: 26–9.
3. 3 Evans K, Roll S, Baker J. Work-Related Musculoskeletal Disorders (WRMSD) among registered diagnostic medical sonographers and vascular technologists: A representative sample. J Diagnostic Med Sonography 2009; 25: 287–99.