# Essentials of Lumbar Spine Rehab

## *Flexion vs. Extension vs. Neutral*

NCMIC

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# Credentials

- NEHS, DC: private practice since 1985
- Board Certified Chiropractic Orthopedics, Rehab & Sports
  - Plus: ART, Graston, MUA, SFMA, CES, PES, FM
- 2023 ACA Rehab Council Doctor of the Year
- Former Chiropractic Doctor for Drew University & RU T&F
- Classifier IWAS 1996 -2017
- Relevant Rehab Seminars: The DeFabio Difference
- Chief of Chiropractic Services
  - DeFabio Spine & Sports Rehab, LLC
- 41+K subscribers on YouTube

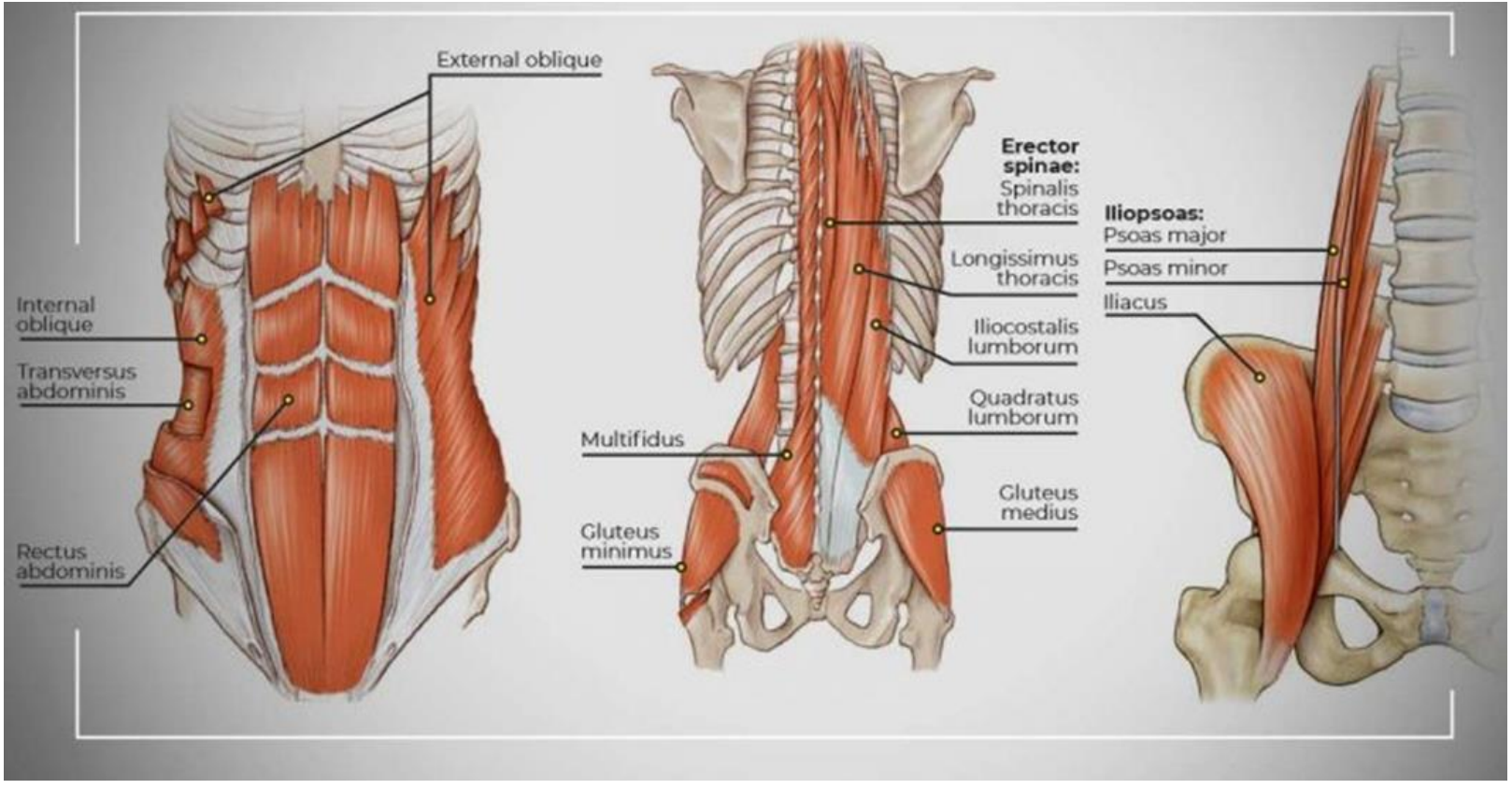
# Disclosures

- Speaker's Bureau NCMIC
- Owner, Relevant Rehab Courses
- Consultant Winback & StoPain

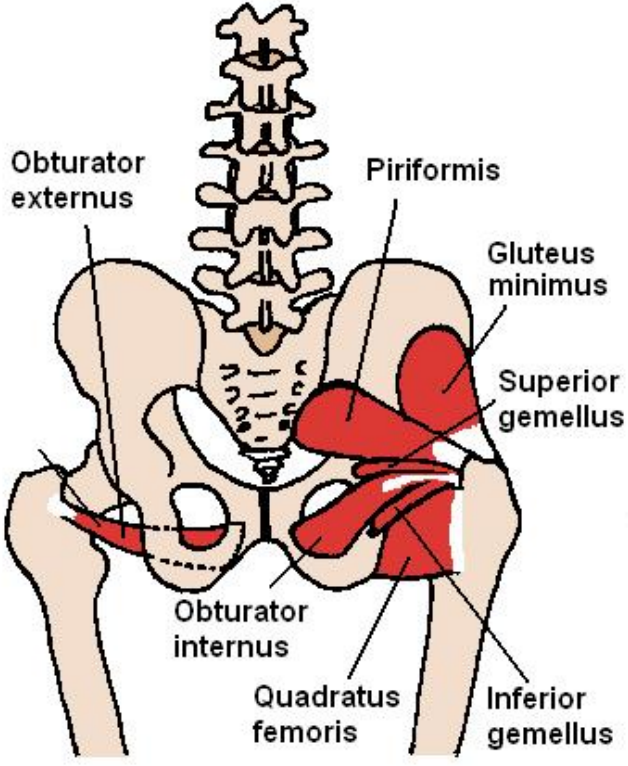
# Learning Objectives

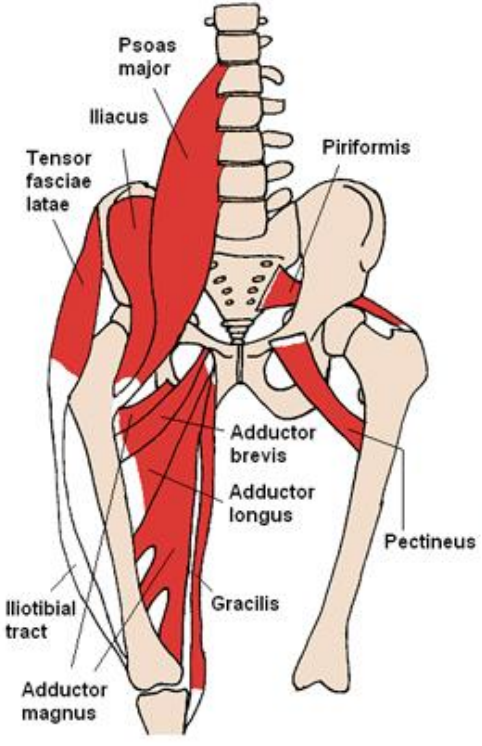
- Review relevant LPHC anatomy
- Create a lumbopelvic hip complex exam flow chart
- Understand core stability mechanisms
- Review lumbar disc kinematics
- Learn exercise principles for the lumbar spine for all phase of care
- Contrast Flexion, Extension & Neutral Spine biased protocols

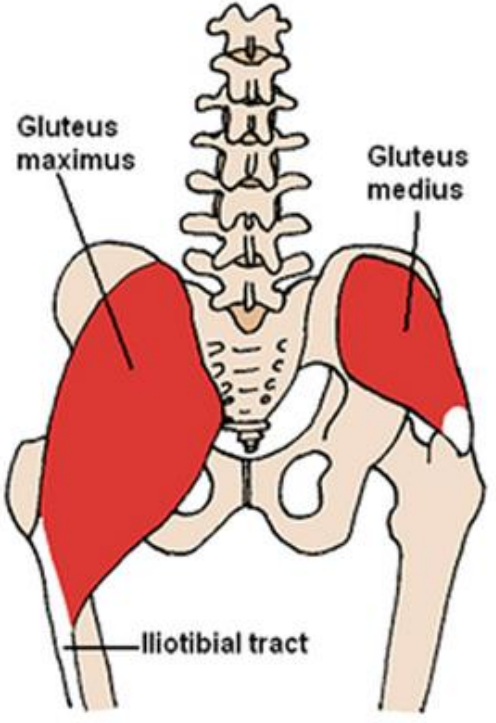
# Relevant Anatomy
# Lumbopelvic Hip Complex (LPHC)

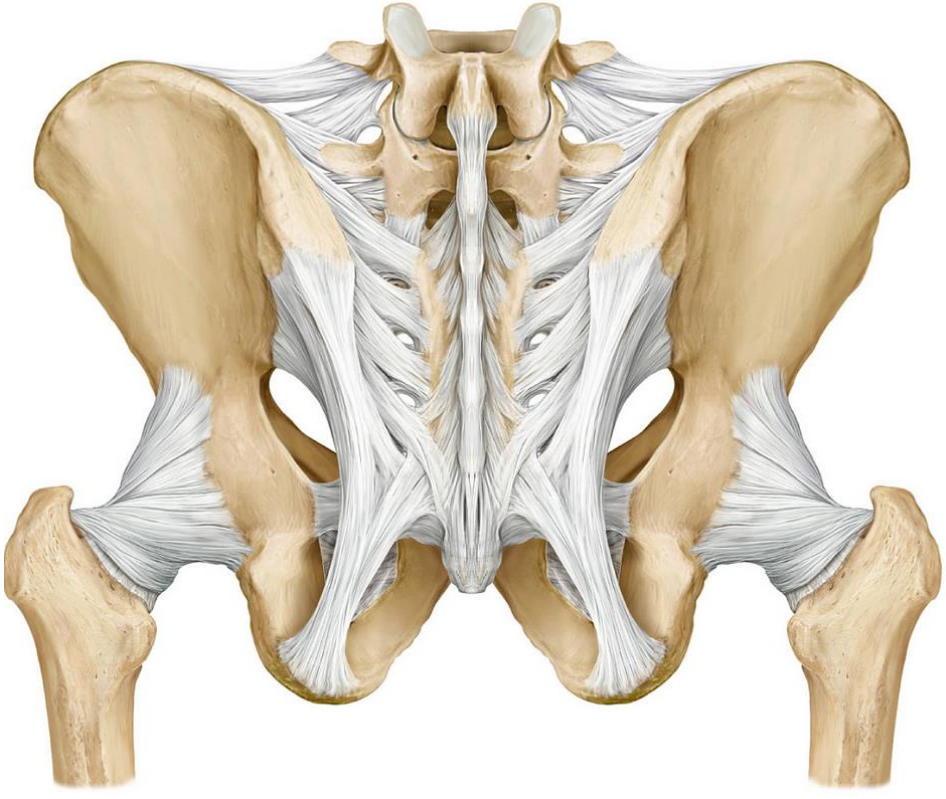


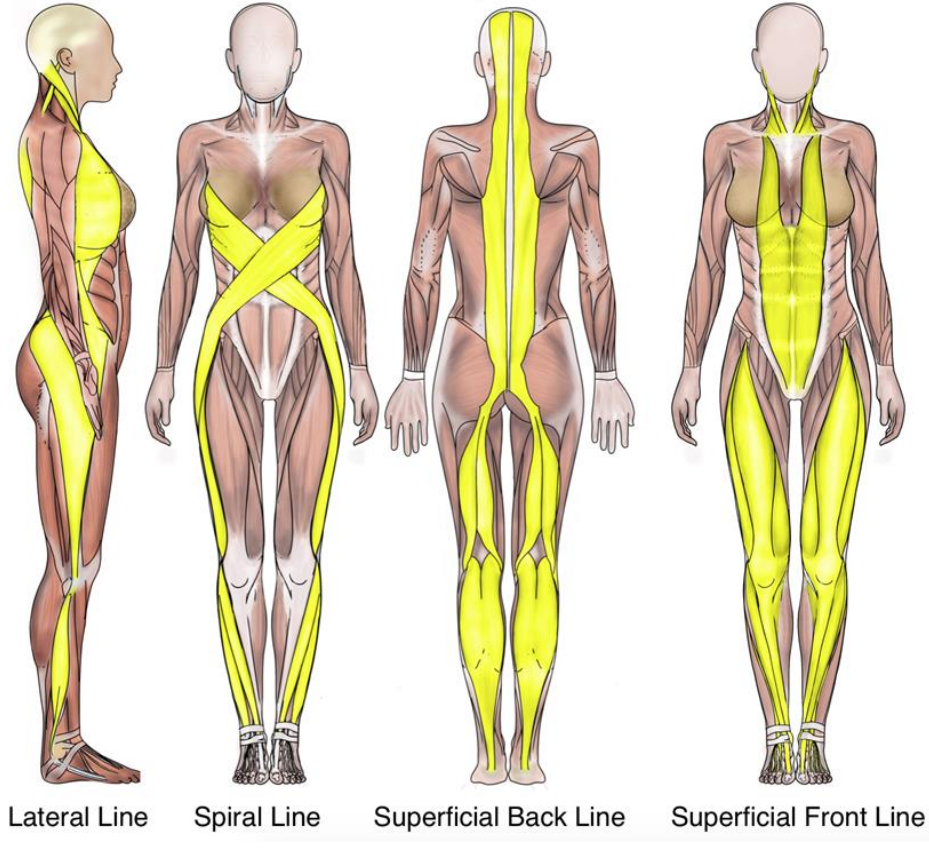
# MUSCLES OF THE HIP COMPLEX





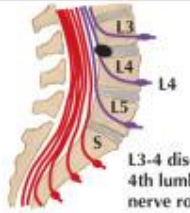
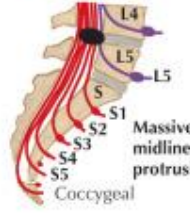

Lateral Line
Spiral Line
Superficial Back Line
Superficial Front Line

# Exam Flow Chart

- Standard Examination
- Static Assessment
  - Postural/Chiropractic Exam
- Movement Patterns
- Dynamic Assessment

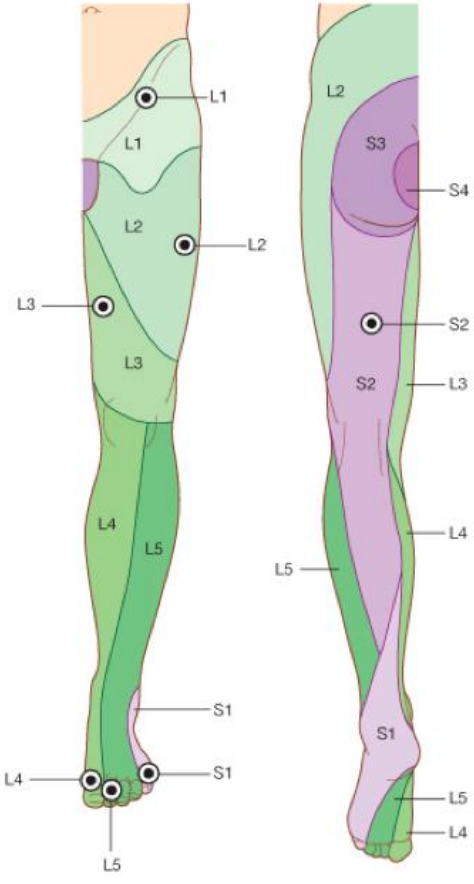
# Lumbar Radiculopathy

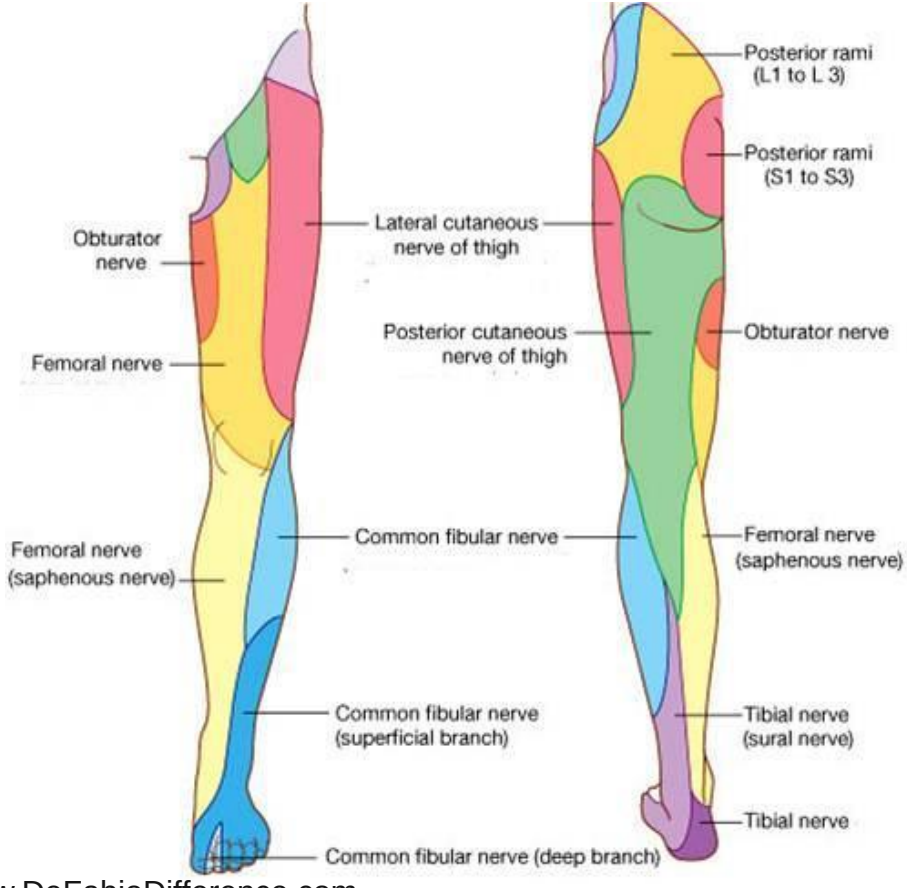
## Clinical Features of Herniated Lumbar Nucleus Pulposus

| Level of Herniation | Pain | Numbness | Weakness | Atrophy | Reflexes |
|---|---|---|---|---|---|
|   L3-4 disc; 4th lumbar nerve root |  Lower back, hip, posterolateral thigh, anterior leg |  Anteromedial thigh and knee |  Quadriceps |  Quadriceps |  Knee jerk diminished |
|   L4-5 disc; 5th lumbar nerve root | Over sacro-iliac joint, hip, lateral thigh and leg  |  Lateral leg, web of great toe |  Dorsiflexion of great toe and foot; difficulty walking on heels; foot drop may occur | Minor | Changes uncommon absent or diminished posterior tibial reflex |
|   L5-S1 disc; 1st sacral nerve root | Over sacro-iliac joint, hip, postero-lateral thigh and leg to heel  |  Back of calf; lateral heel, foot and toe | Plantar flexion of foot and great toe may be affected; difficulty walking on toes |  Gastrocnemius and soleus |  Ankle jerk diminished or absent |
|   Massive midline protrusion | Lower back, thighs, legs, and/or perineum depending on level of lesion; may be bilateral | Thighs, legs, feet, and/or perineum; variable; may be bilateral | Variable paralysis or paresis of legs and/or bowel and bladder inconti-nence | May be extensive |  Ankle jerk diminished or absent |

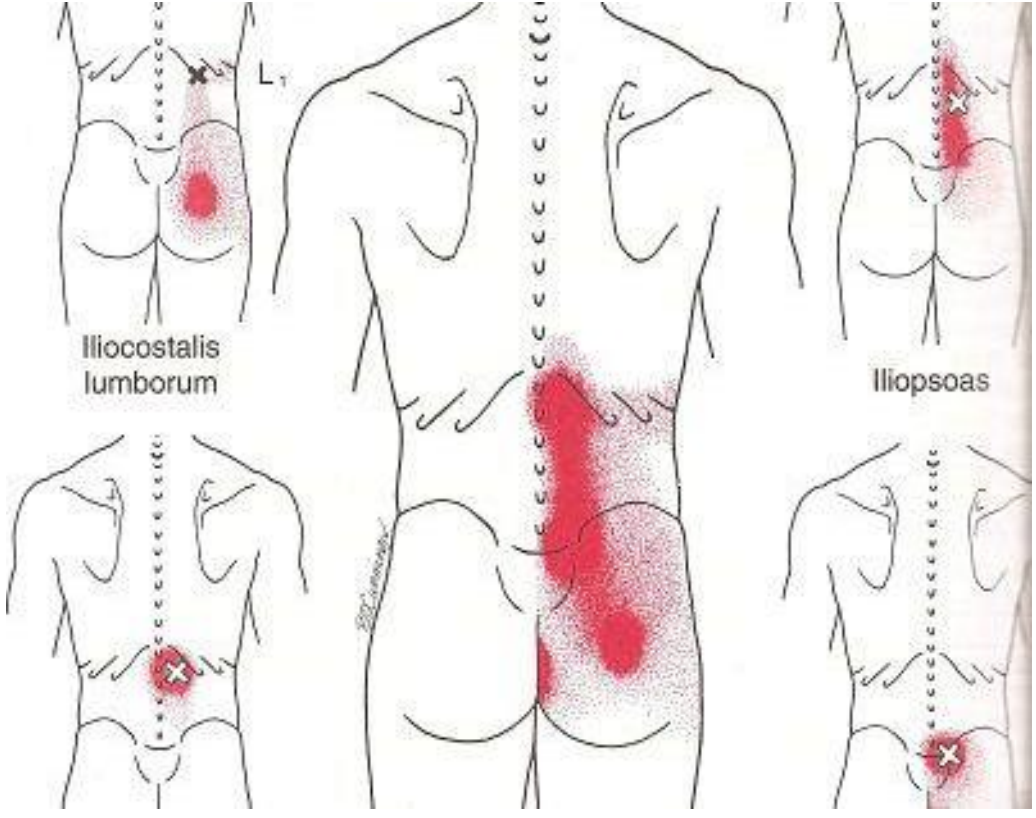
F. Netter, M.D.

# LE Sensation Review



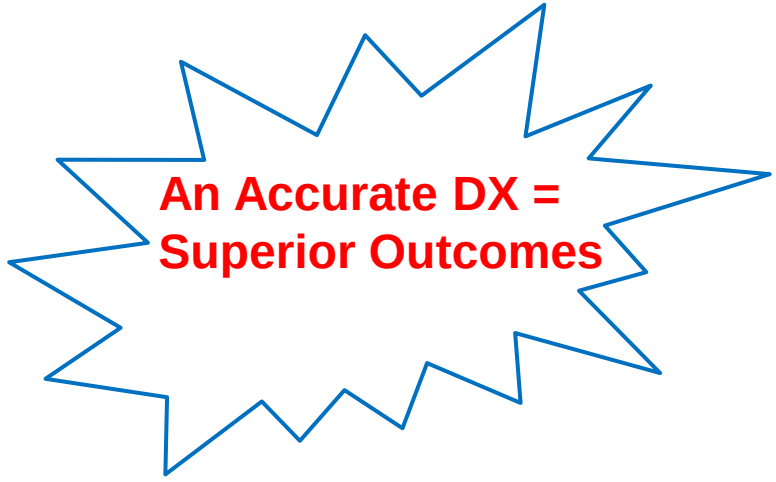



# Trigger Points



# A Thorough Examination

- ROM
- Nerve Traction Signs
- Nerve Compression
- Disc?
- Muscular?
- Facet?
- SI / Pelvis?
- Hip?
- Atlas?
- Underlying pathology?



# Core Stability

# Stabilization vs. Movement

## Stabilization

- A “local” muscle system
  - Creates segmental spinal stabilization
- Provides little joint motion
- Creates a stable foundation for movement
- Prone to weakness
- Inner Unit

## Movement

- A “global” muscle system
  - Creates movement, power speed
- Provides regional stabilization
- Prime movers
- Prone to tightness
- Outer Unit

# Core Musculature

## Stabilization

- TA
- Internal Oblique
- Multifidi
- Lumbar Transversospinalis
- Pelvic Floor
- Diaphragm
- Glut Med*
- Deep Erector Spinae*
- Longus Coli/Capitus*
- Deep Cervical Flexors*

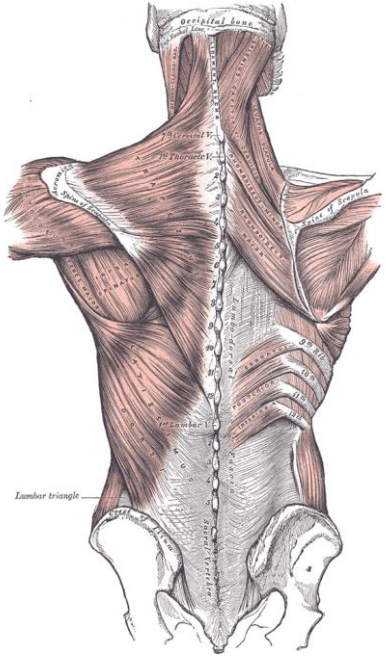
## Movement

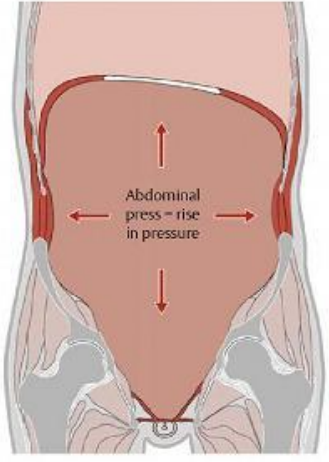
- Rectus Abdominus
- External Oblique
- Erector Spinae
- Quadratus Lumborum
- Adductors
- Quadriceps
- Hamstrings
- Glut Max
- Psoas*
- Latissimus Dorsi*
- Scalenes*

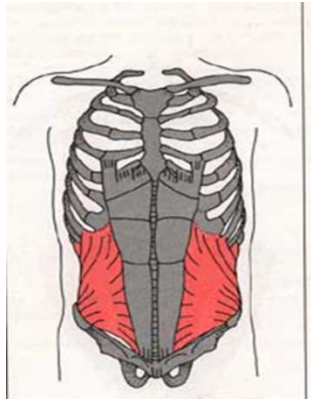
# Mechanisms of Core Stability

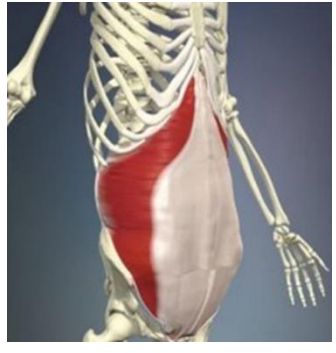
- Thoracolumbar Stabilization
- Intra-abdominal Pressure
- Hydraulic Amplifier

# Thoracolumbar Stabilization



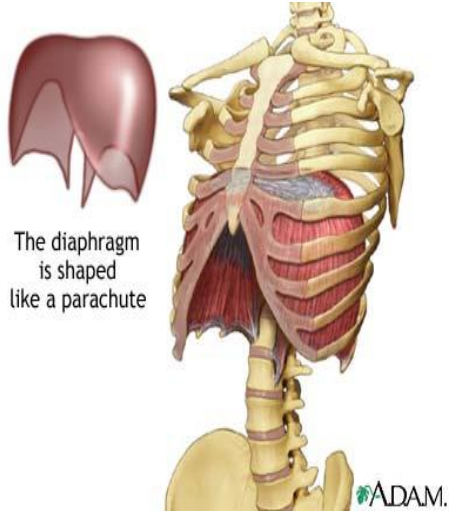



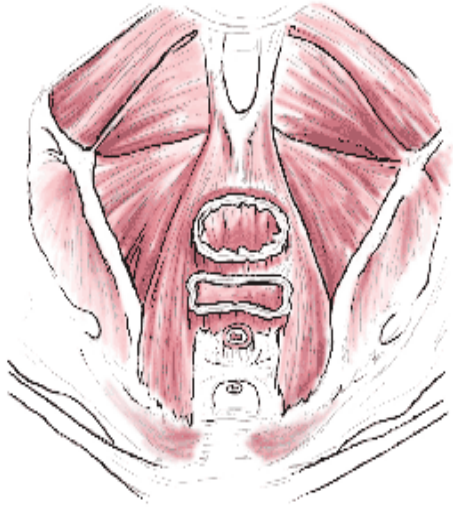





- Reduces translational and rotational stress at the LS junction

# Intra-abdominal Pressure Mechanism

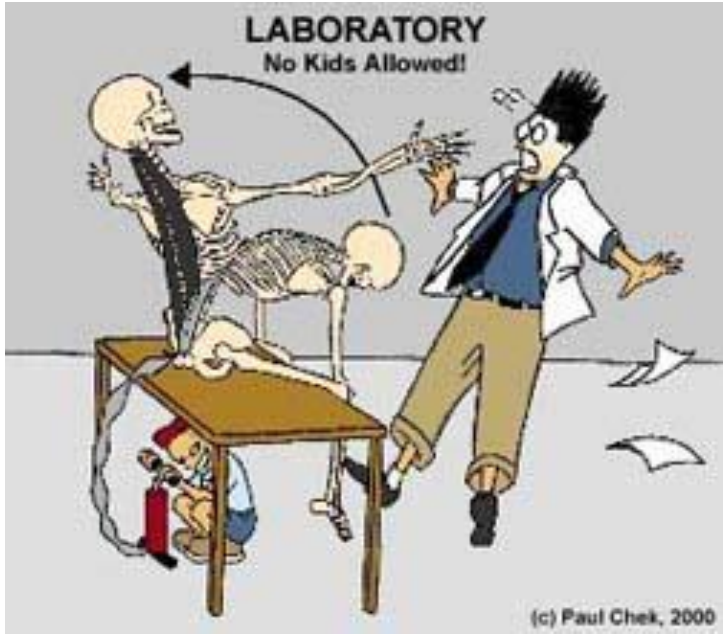


- Reduces compression at the LS junction

# Hydraulic Amplifier Mechanism

- After the relaxation response in the LS, to return erect, load sifting occurs into the non-contractile LPHC elements and into the eccentrically contracting gluts and hamstrings
- This energy is stored in these tissues & is converted to kinetic energy with lumbar extension
- Requires an efficient TL fascia



# Bracing

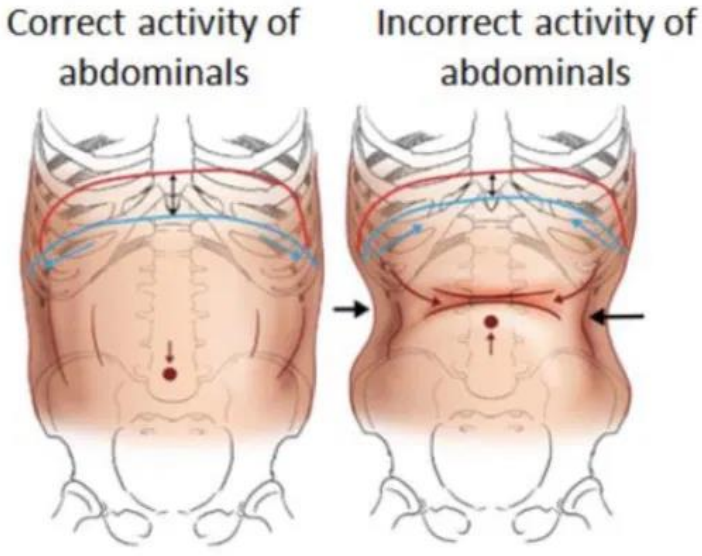



Figure 1

Pictures by Prague School of Rehabilitation

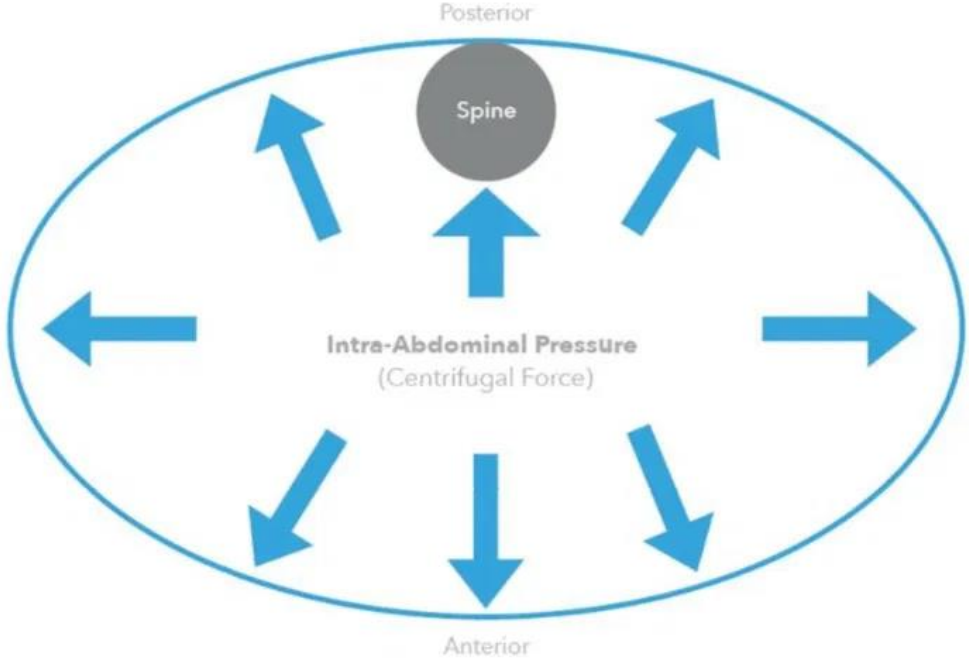



Figure 2

# Abdominal Hollowing vs. Bracing vs. Natural Strategy

- Abdominal hollowing was the most ineffective & did not increase stability.
- Abdominal bracing did improve stability but increases spinal compression.

The Myth of Core Stability, Lederman E, JBMT (2010) 14 ,84-98

# Abdominal Hollowing w/ Pelvic Tilt

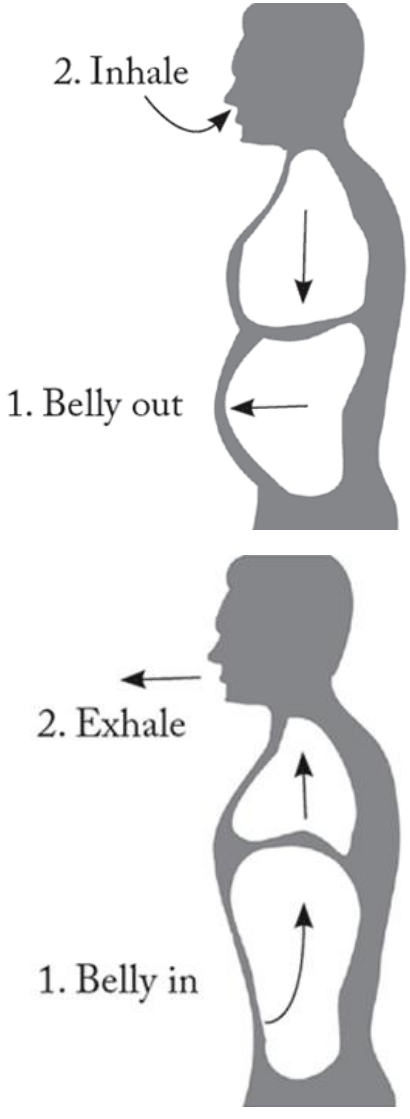
- EMG shows increased stiffness is significantly less compared to neutral bracing due to decreased activation of other abdominal wall muscles
- Causes inhibition of the erector spinae
- Makes it beneficial in the early stages of lumbar spine rehabilitation since the erectors are often shortened & weak

# Integrating abdominal hollowing into the prone plank exercise enhances overall abdominal activity, particularly in both obliques

**Influence of Abdominal Hollowing Maneuver on the Core Musculature Activation during the Prone Plank Exercise, García-Jaén M, J Int Environ Res Public Health 2020 Oct**

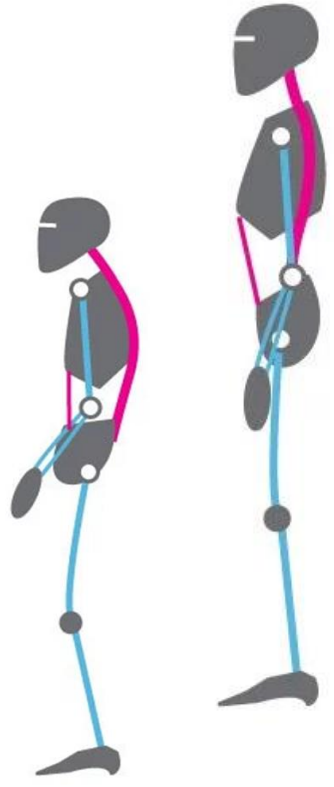
# The Take Home

- Abdominal hollowing can provide relief, kinesthetic awareness, motor control education, & early activation of the TA & multifidi in the acute LBP patient
  - Once weight bearing postures begin (ADL / rehab) neutral spine bracing is preferred
- Neutral spine is preferred to enhance multiplanar stability & functional movements
- Abdominal hollowing & neutral spine bracing allow for local stability to prepare for functional, comprehensive spinal stability

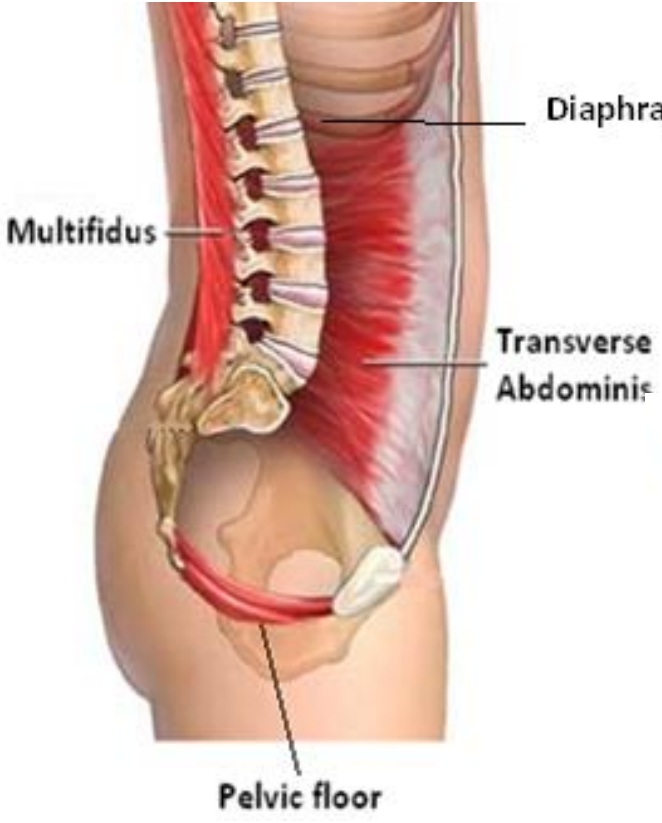



# Breathing

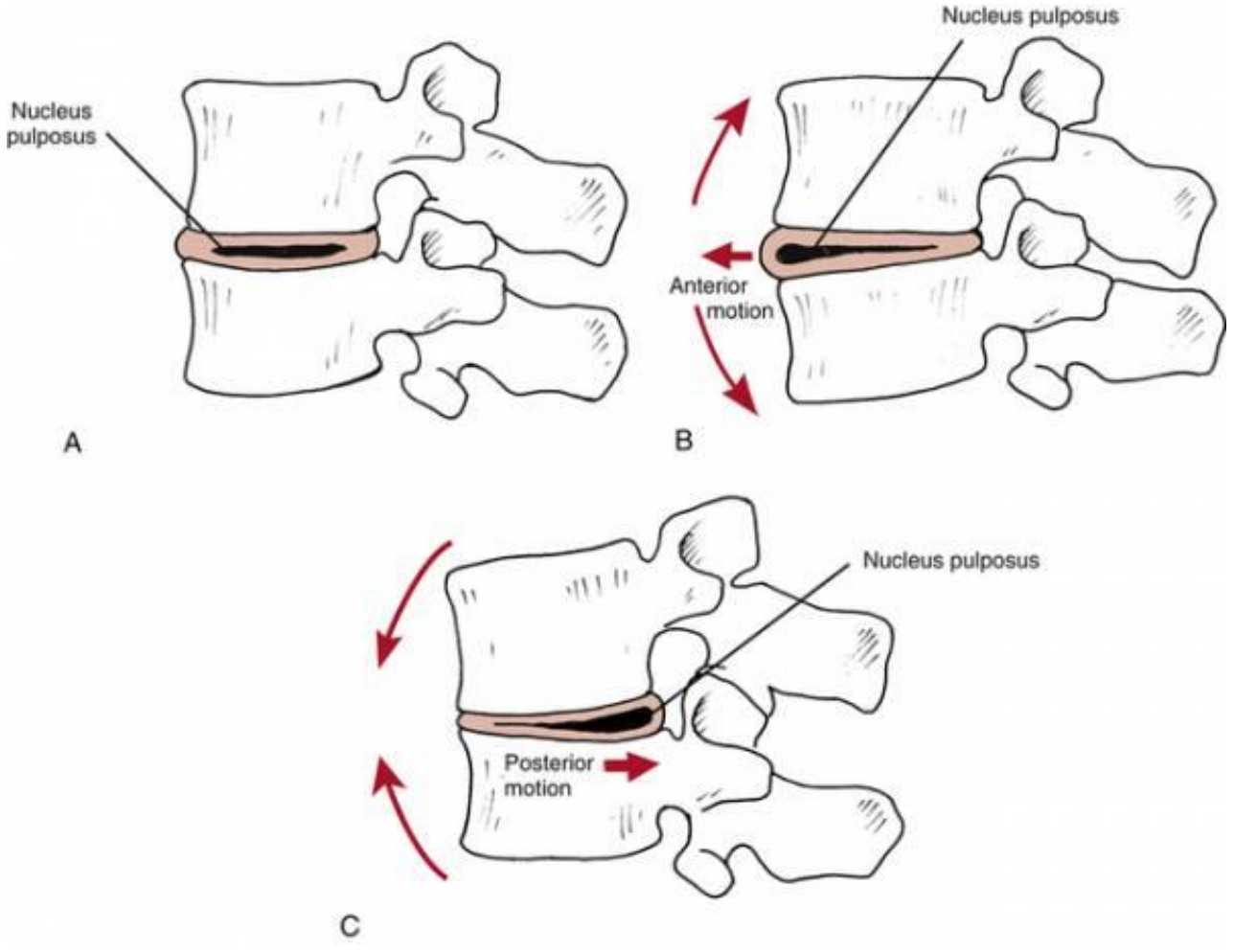
- Abdominal breathing strengthens deep core muscles
- Learn to keep the chest quiet
- “Bellows effect”
- Oxygenates tissues?



# Abd Breathing

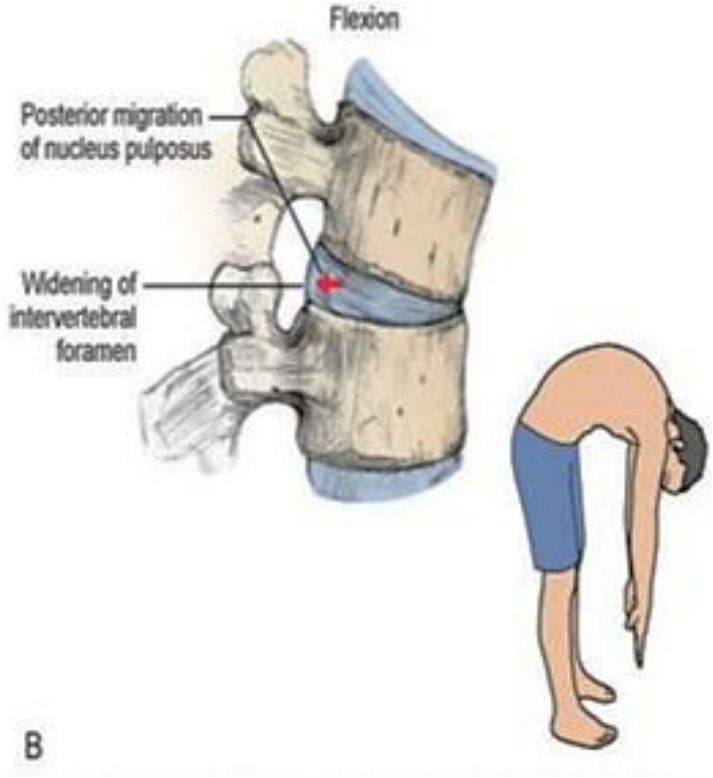



# Disc Review


Nucleus pulposus
A
Nucleus pulposus
Anterior motion
B
Nucleus pulposus
Posterior motion
C

# Flexion Principles

- Traditionally the standard for acute LBP and LS disc syndromes
- Often a position of relief
- Distracts apophyseal joints
- Relaxes erector spinae
  - Noted on EMG
- Opens the IVF
  - Cox, flexion-distraction
  - Williams Exercises
  - Logan Basic & SOT



# Williams Exercises

- Originally designed for chronic low back pain patients in 1930's
  - Men younger than 50 yo
  - Women younger than 40 yo
  - W/moderate to severe lumbar lordosis
  - W/diminished disc space at L1-S1 on XR
- Intent: to improve lumbar flexion, avoid surgery, & strengthen the gluts and abdominals
- Perfect in the acute and sub-acute phase
- Long term: maintains ROM

D. Seated reach to toes to stretch the hamstrings and erector spinae

E. Forward crouch to stretch the iliofemoral ligament

F. Seated flexion

A. Pelvic tilt

B. Sit-up in knee flexion

# Williams Exercises

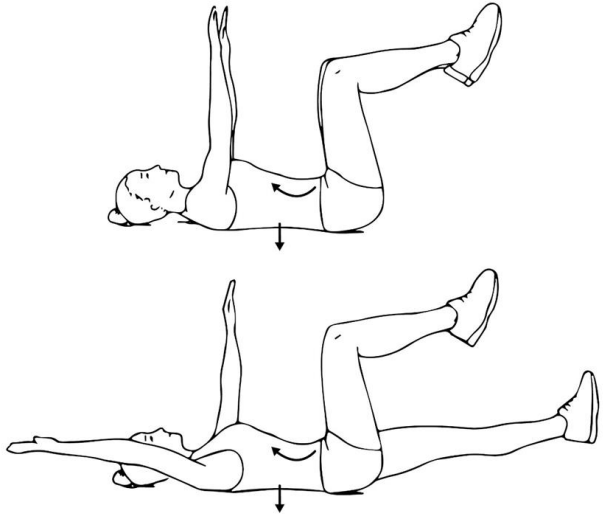
www.DeFabioDIfference.com

# Strength and Stability for Flexion Bias: Dead Bug in *FLEXION*

- Supine Hooklying
- Lumbar Flexion
- Breathe

## Dead Bug Position

- Supine, arms only
- Supine, legs only
- Alternate arms and legs
- Add resistance
- Add unstable surface

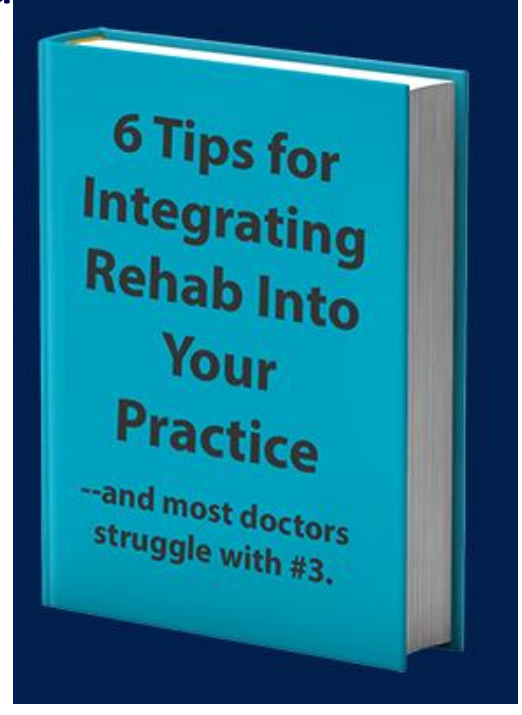


# Flexion Exercises

- Acute LBP
  - W/ or w/o sciatica
- Lumbar DJD / Spondylosis
- Spinal Stenosis
- Spondylolisthesis
- Facet imbrication (secondary to hyperlordosis)
- Janda's Lower Crossed Syndrome
- Disc syndromes (Note: MDT extension protocols are well referenced for lumbar HNP treatment)

# TAKE A BREAK!

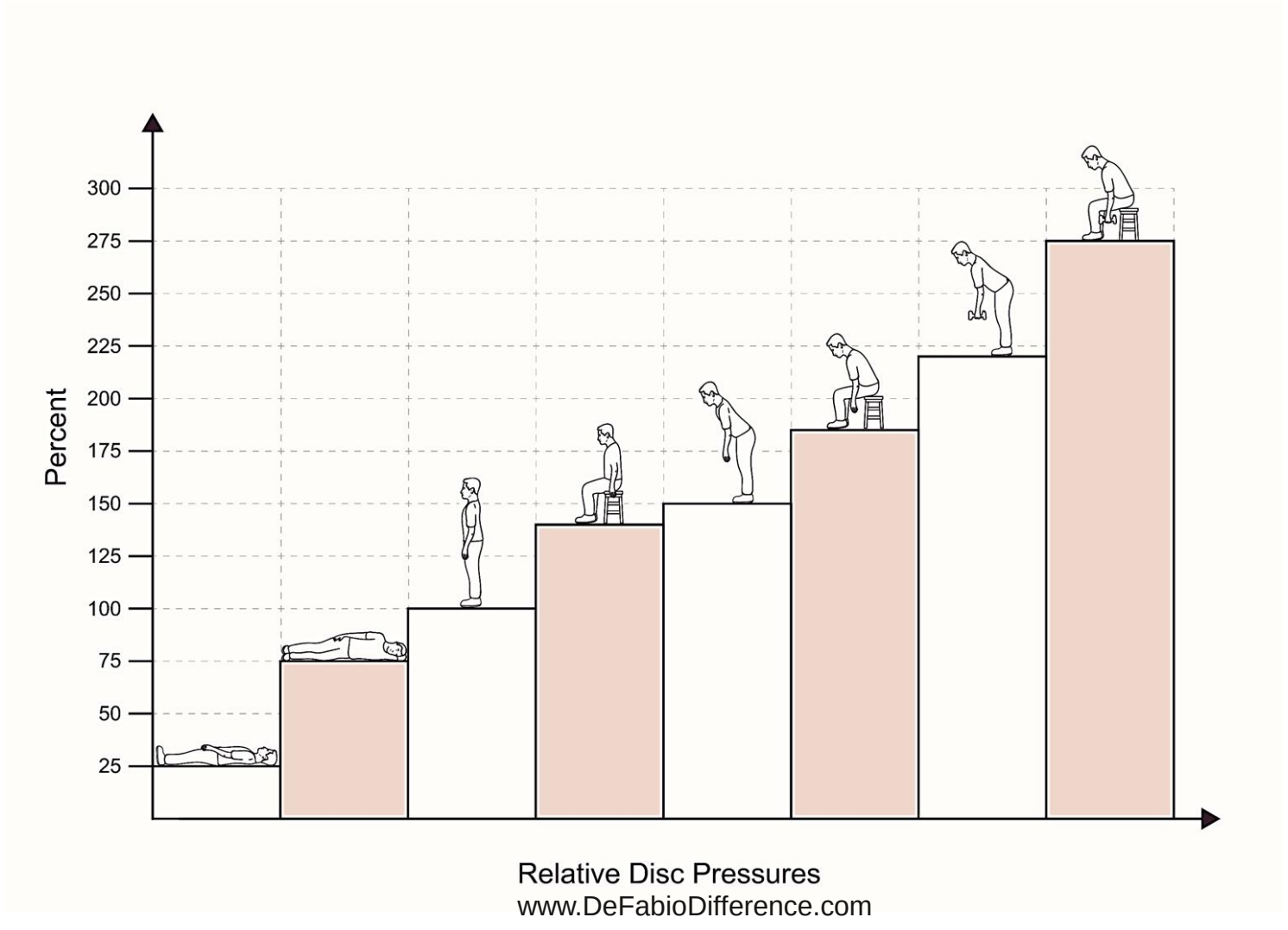
- Don DeFabio, DC, DACBSP, DACRB, DABCO
- Rehab Tips & Patient Tear Sheets
- *GOOGLE*: DeFabio Difference & leave a review
  - Relevant Rehab Seminars
  - CCSP to Rehab Diplomate Program
  - One on One Consulting
- DeFabioDifference.com
  - Download Free e-book!



# Neutral Spine: The Rationale

- Lumbar discs are at maximal load at 30˚of flexion
- Combined with compressive loading and/or **repetitive insult** leads to  disc failure
- From exercises in lumbar flexion, (crunches and sit-ups), exercises done improperly, (seated rows, bent over rows, deadlifts, back squats), or ADL's in flexion, (sitting at a desk)

Repeated lumbar flexion creates abnormal arthrokinematics and discogenic changes


Percent
300
275
250
225
200
175
150
125
100
75
50
25
Relative Disc Pressures
www.DeFabioDifference.com

# Spinal Compression Loads w/ Exercise

| Exercise | Compression Load |
|---|---|
| Sit-up (bent knee) | 3,300N (730lb) |
| Sit-up (straight leg) | 3,506 |
| Curl-up feet anchored | 2,009 |
| Curl-up feet free | 1,991 |
| Quarter sit-up | 2,392 |
| Bent leg raise | 1,767 |
| Hanging straight leg | 2,805 |
| Hanging bent leg | 3,313 |
| Isometric side bridge | 2,585 |
| Roman chair extension | 4,000 |
| Back extension (arms and legs) | 6,000 |
| Bird dog | 2,000 |

*Table sourced from McGill S, Low Back Disorders: Evidence Based Prevention & Rehabilitation, Human Kinetics, 2002.*

# McGill

- Maintain neutral spine
- Protects the disc
- Creates efficient movement patterns

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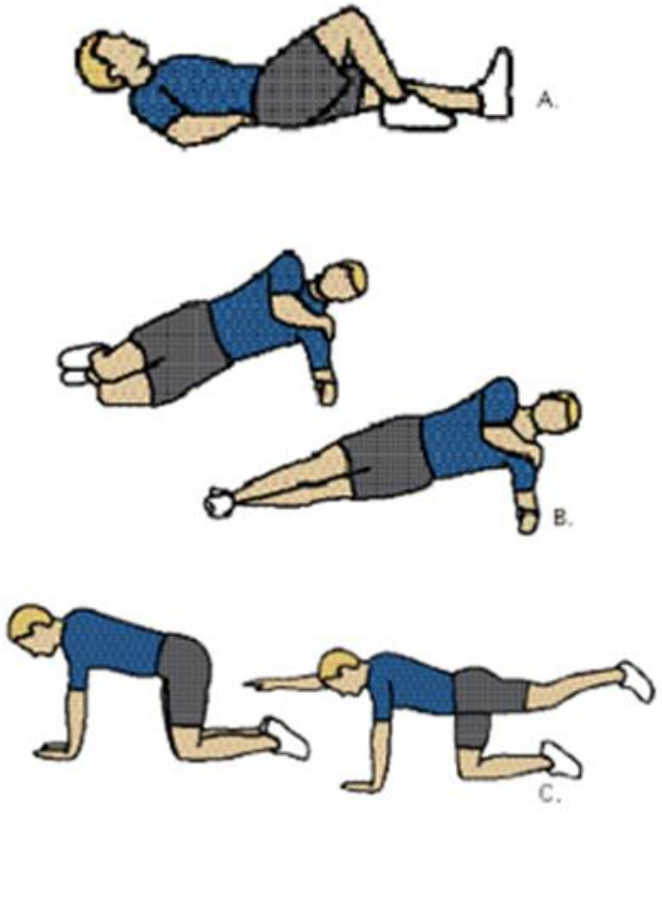
# McGill's "Top 3"

- Curl-up
- Side plank
- Quadruped

Goal: Re-groove movement pattern w/ spinal stiffness in "neutral"

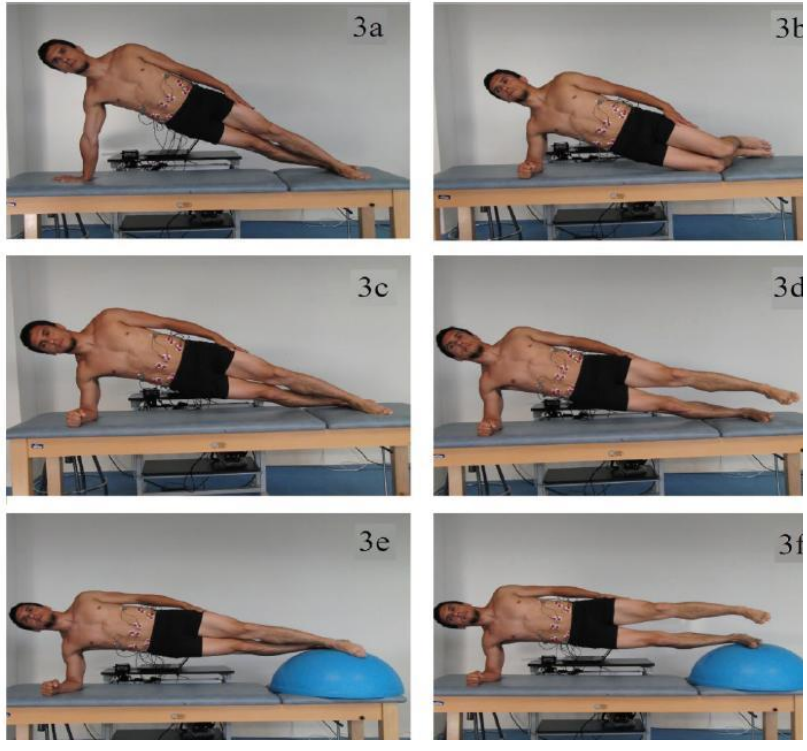


# McGill Curl –Up Progression

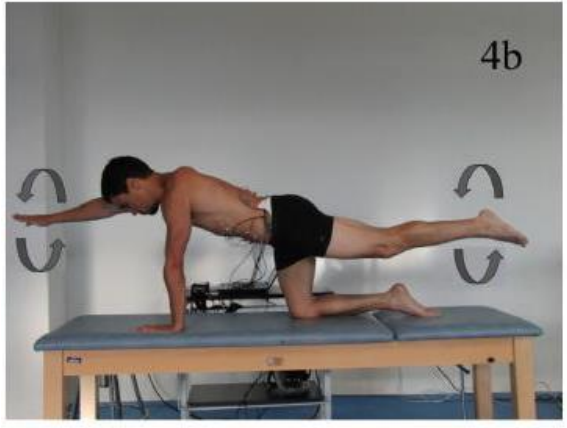
- Elevate head and shoulders 1”, w/o CS flexion, passive neutral lumbar spine
- Actively maintain LS neutral and lift arms 1” towards feet
- Cross arms  on the chest
- Place hands behind head
- Add pre-brace
- Add unstable surface
- Avoid lumbar flexion

# Side Plank Progression

- Three-point position
- 3 – point with bridge
- Split stance: stiff arm
- Split stance: bent arm
- Split stance w/ unstable surface
- Single leg*



# Quadruped Progression

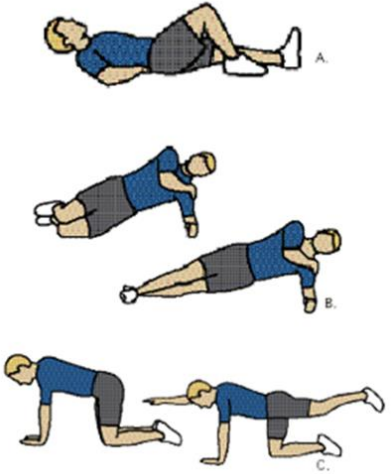





Quadruped

# Bracing:
# Neutral Spine vs. Flexion

- Neutral Spine
- Increase endurance to decrease arthrokinematic breakdown



- Flexion
- Emphasizes TL fascia mechanism
- Engages lower abdominals & Opens Facets

# Mechanical Diagnosis Therapy……*MDT*

- Developed in the 1950's by Robin McKenzie, PT
- Has become synonymous with spinal extension exercises
- Uses a classification system for diagnosis and treatment
- Emphasizes centralization of spinal and radicular pain
- Uses targeted repetitive HEP approximately 10X per day
- Caveat: giving the 'wrong' direction of exercises can lead to poorer outcomes.

# MDT Classifications

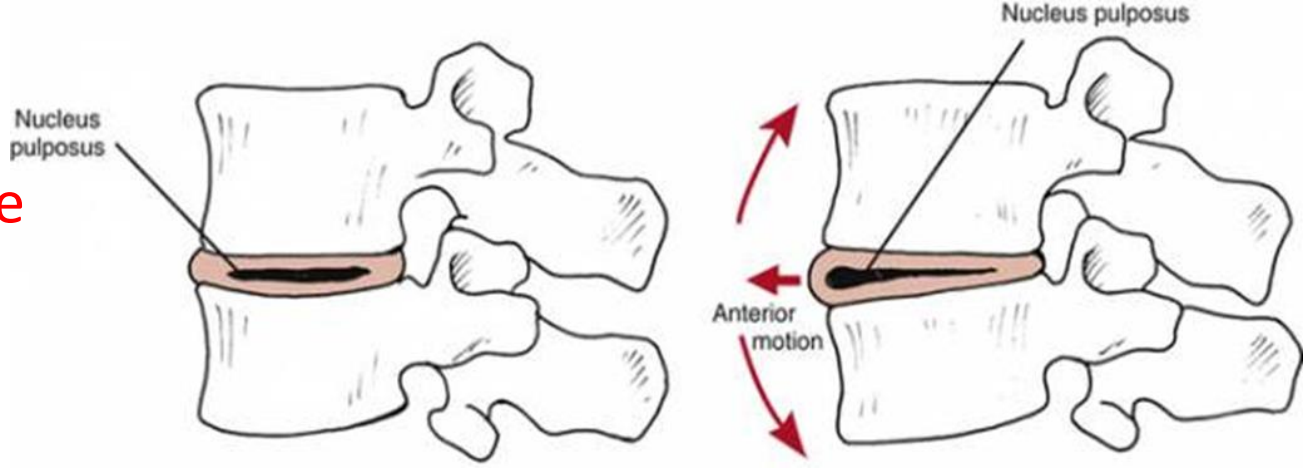
- **Postural**
  - Soft tissue deformation from prolonged postural stresses
  - Repeated movements should not affect symptoms
  - Relief occurs immediately following correction of abnormal posture
- **Dysfunction**
  - Mechanical deformation of impaired soft tissue
  - Tissue contraction, scarring, adhesion, or adaptive shortening due to traumatic, inflammatory, or degenerative processes
  - Loss of movement and pain at the end range
  - Numerous subsyndromes: including flexion!
  - Treatment: HEP & mobilization exercises focused in the direction of dysfunction/pain
  - Treatment  goal is tissue remodeling

# MDT Classifications

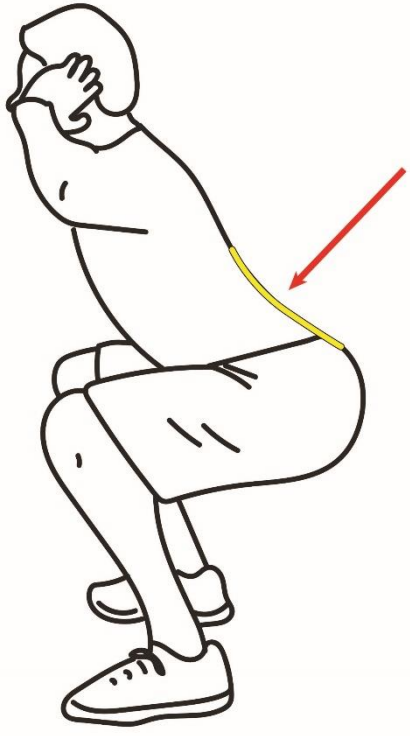
- **Derangement**
  - Most common MDT classification: up to 78%
  - Pain & loss of ROM in the direction of derangement
  - Often discogenic
  - Centralization and peripheralization are monitored
  - Approximately 58% to 91% show centralization of pain
    - 67% to 85% prefer extension
  - Numerous subsyndromes
  - Treatment: repetitive movements in a single direction that reduces pain
- **Other**
  - Spinal stenosis, SIJ, hip disorders, zygapophyseal disorders, post-surgical complications, spondylolysis, spondylolisthesis, etc….

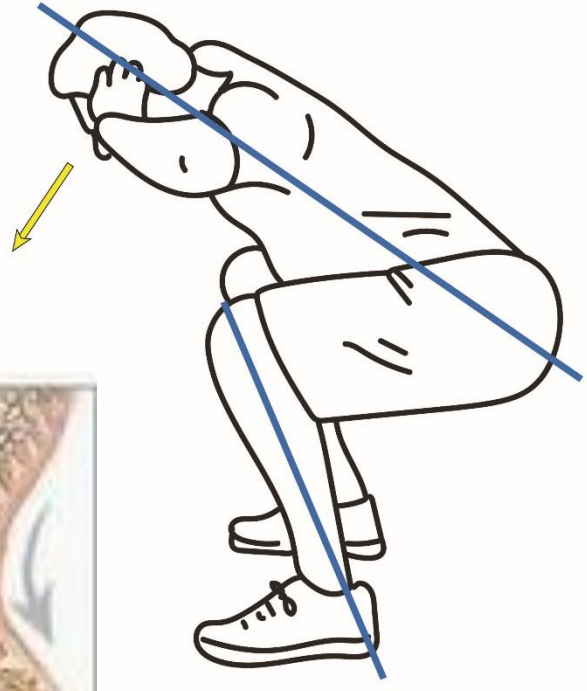
# Extension Indicators

- Disc syndromes
- Hip flexor tightness
  - Iliopsoas complex
  - Anterior hip capsule restriction
- Anterior SI ligament dysfunction
- Flexion dominant movement LPHC



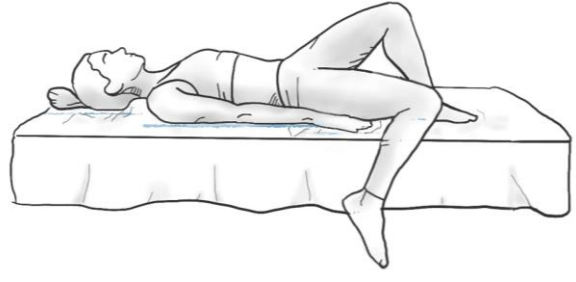
# Extension Indicators





# Passive Extension

- Lengthens the anterior chain
- Promotes anterior migration of the nucleus pulposus
- Mobilizes the apophyseal joints
- Localized pain may be allowed
- Peripheralization is to be avoided



# Stability & Strength w/ Extension

- Treat the entire posterior chain
- Hamstrings, glut max/med, LS extensors, QL
- End range loading
- Prone alternate reciprocal movement
  - Static hold activates multifidi and erector spinae

# Stability and Strength w/ Extension

- Isometric hold with slow release
- Prone to seated
- Reactive isometrics seated

# The Best? Moderate- to high-quality Evidence:

- *MDT is not superior* to other rehabilitation interventions for reducing pain and disability in *acute LBP*
- *MDT is superior* to other rehabilitation interventions for reducing pain and disability in *chronic LBP*
- Depends on the type of intervention being compared to MDT

J Orthop Sports Phys Ther 2018;48(6):476-490.

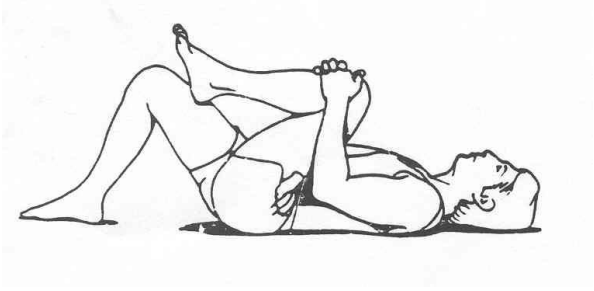

**Williams?**

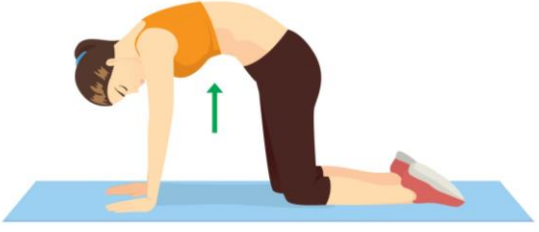
**McKenzie?**

**McGill?**

# Acute Low Back Patient

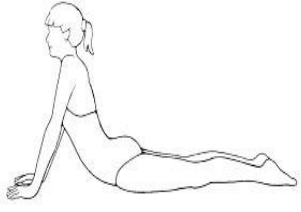
- Goal: maintain ROM and shut down inflammatory cascade
- Position of relief?
- Flexion
  - Williams
  - Bracing in flexion
- Extension
  - Prone press up to Cobra
- Walk ASAP
- Other:
  - Cat/Cow
  - Piriformis



# Low Back Stretches

- Knee to chest
- Figure “4”
- Hip Flexor
- Prone Extension
- Seated Hamstring

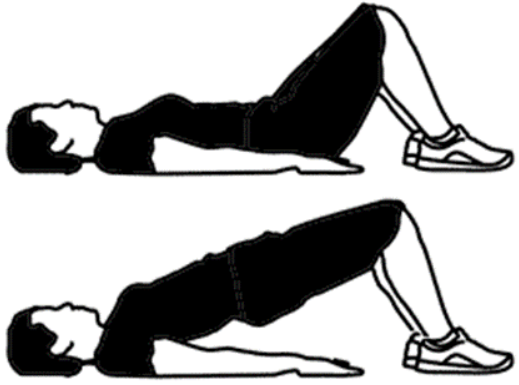
Helps maintain ROM

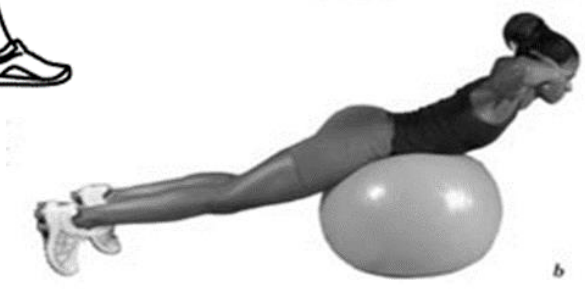
Excellent for the acute patient

Increases hip compliance

# Sub-acute: Add stability

- Flexion:
  - Dead Bug progression
- Extension:
  - End range ext
  - Bridges
- Neutral:
  - McGill's Top-3
- Other
  - Bracing
  - Clamshells





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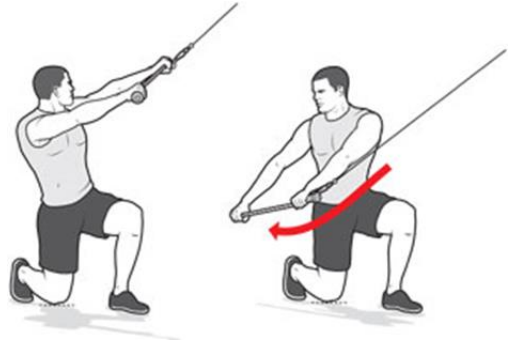
# Rehabilitative & RTP

- Flexion
  - Dead Bugs w/ biofeedback
  - Gait retraining
- Extension
  - End Range loading
  - Unstable surface
  - RDL's: Good Morning's
- Neutral
  - Unstable surface
  - Chops
  - Planks
  - Plyo's
- Other
  - Physio ball
  - Table top bridges
  - Abdominal breathing



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# Dosing

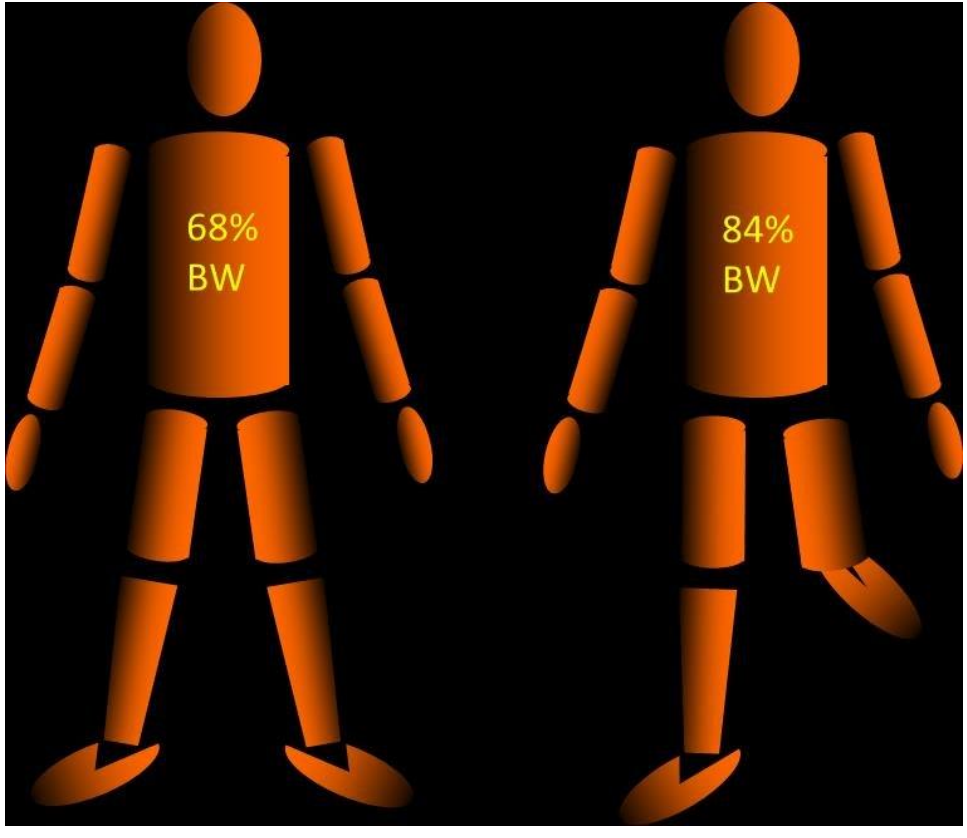
## Stretches

- Pain –free ROM
- Hold 30-60 seconds
- Breathe
- 3 reps
- 1-3X/day

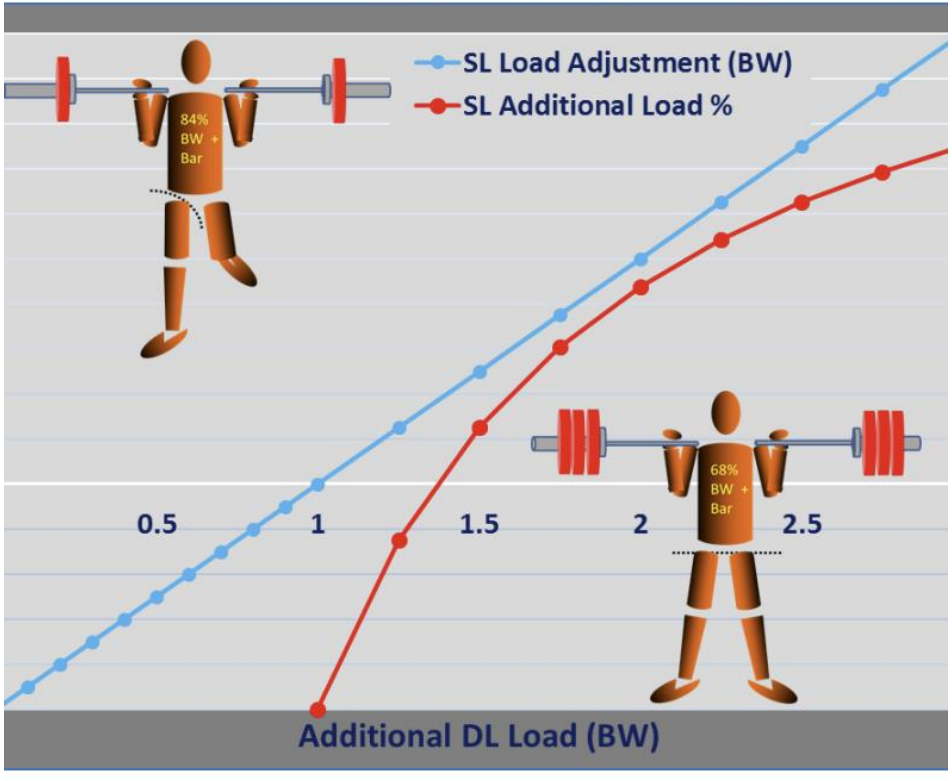
## Stabilization

- Pain-free ROM
- Tempo: 2:2:4
- Breathe
- 10-20 reps
- 3 sets
- 1-3X/day

# Safely Increasing Load



# Graham-Smith et al, UKSCA's 11th Annual Conference, August 2015 - Chesford Grange, Warwickshire



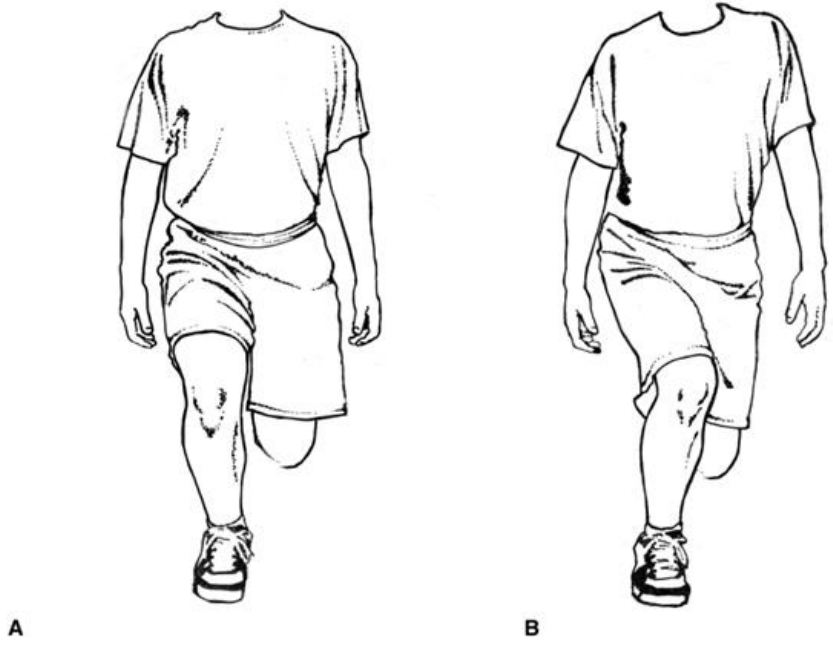

- Additional loads of less than one BW in a DL movement will not develop the same level of loading compared to a SL movement with no load
- An additional load of one BW applied to a SL movement is the equivalent to a DL movement with an additional load of 3 BW (1/3of DL add'l load)

# Dynamic Assessment

- Thomas Test
  - Iliopsoas vs. Rectus Femoris vs. ITB

# Dynamic Trendelenburg

- Gluteus Medius
- Acetabular/Knee/Ankle dysfunction



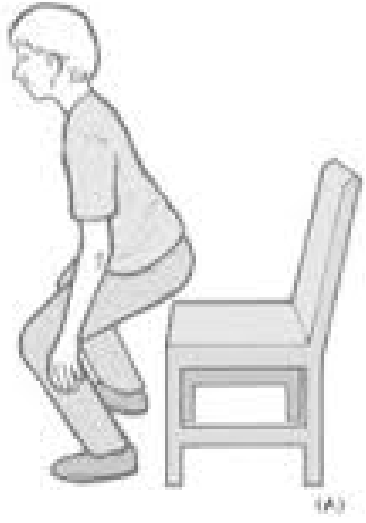
# Squat Mechanics

# Squat Patho-mechanics

- Torso Falls Forward
  - Tightness: Iliopsoas, Lats
  - Weakness: LS Erectors, Glut Max
- LS Flattens
  - Tightness: Hamstrings
  - Weakness: Hip Flexors, TA
- LS Arches
  - Tightness: Hip Flexors
  - Weakness: TA
- Pelvic Obliquity
  - Tight: Adductors: TFL (IPSI), Piriformis, Glut Med (Opp)
  - Weak: Glut Med, Piriformis, BF (IPSI):ADD, TFL (Opp)

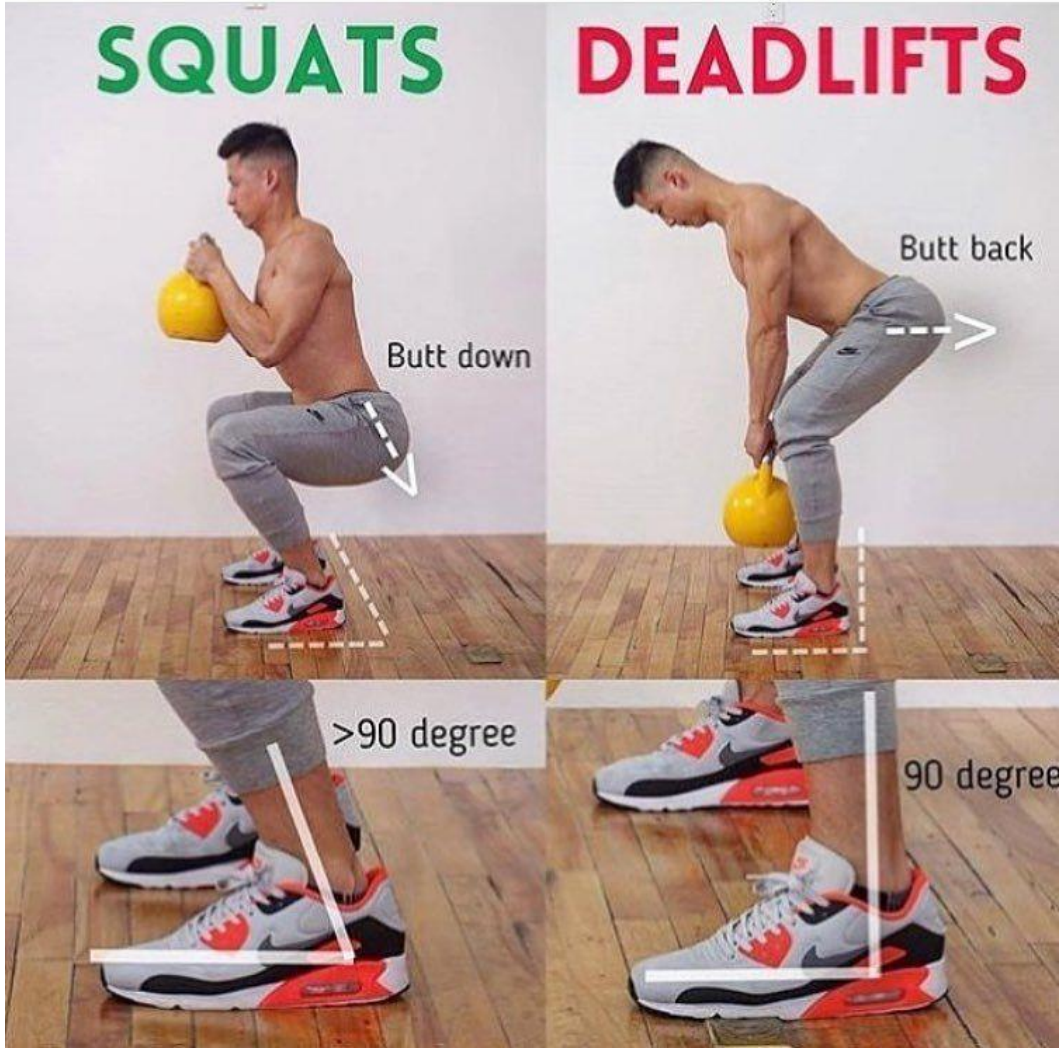
# Developing the Hip Hinge

- Kneeling Hip Hinge
- Sit to Stand
- Ball Squats
- RDL's




Contingent on foot and ankle mechanics

# Hip Hinge vs. Hip Flexion

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# Kinesiology Tape

- Neurosensory stimulation
- Can address:
  - Muscle, fascia, functional movements
- No tension on taps
- Clean, dry skin
- Lengthen soft tissue involved
- Stretch @20-25%
  - Less is more!
- Heat increases adhesion

# K- Tape






# Additional Resources

- @NCMIC
- Don DeFabio, DC, DACBSP, DACRB, DABCO
  - Relevant Rehab Seminars
    - *CCSP to Rehab Diplomate program*
    - www.DeFabioDifference.com
  - One on One Consulting
- You Tube:  Dr DeFabio

# Thank You!

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