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LUMBAR SPINE CASE #1

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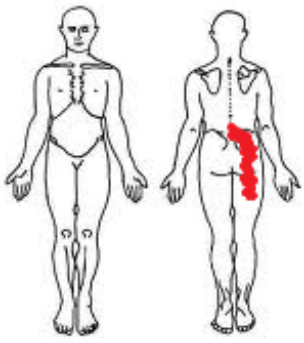
Orthopaedic Manual Physical Therapy Series
Charlottesville 2017-2018

VOMPTI_CLINICAL REASONING FORM



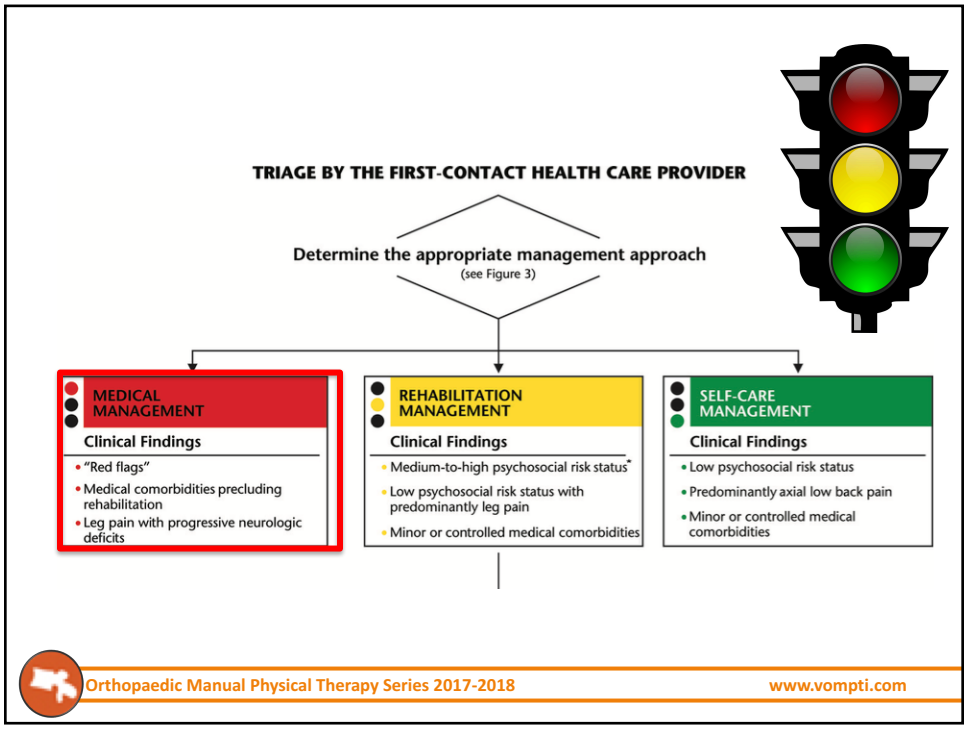
Body Chart – Initial Hypothesis:

L4-5, 5-S1 disc, facet (somatic)

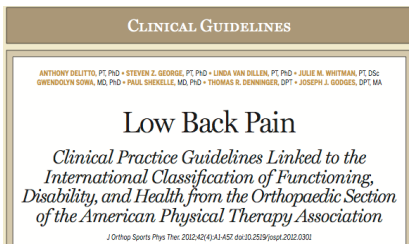
L4-5, 5-1 radiculopathy

SIJ pain

Extra-articular hip pathology



Differential Diagnosis "Red Flag screening"


CLINICAL GUIDELINES

ANTHONY DELITTO, PT, PhD • STEVEN Z. GEORGE, PT, PhD • LINDA VAN DILLEN, PT, PhD • JULIE M. WHITMAN, PT, DSc
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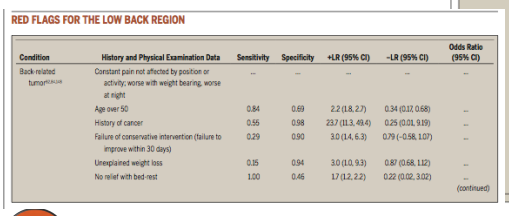
Low Back Pain

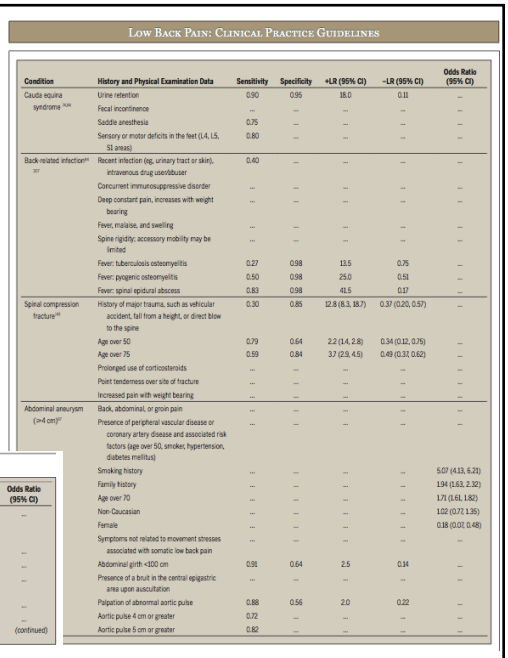
Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association

J Orthop Sports Phys Ther. 2012;42(4):A1-A57. doi:10.2519/jospt.2012.0301


RED FLAGS FOR THE LOW BACK REGION

Condition	History and Physical Examination Data	Sensitivity	Specificity	+LR (95% CI)	−LR (95% CI)	Odds Ratio (95% CI)
Back-related tumor[42,44,108]	Constant pain not affected by position or activity; worse with weight bearing, worse at night	...	...	...	...	...
	Age over 50	0.84	0.69	2.2 (1.8, 2.7)	0.34 (0.17, 0.68)	...
	History of cancer	0.55	0.98	23.7 (11.3, 49.4)	0.25 (0.01, 9.19)	...
	Failure of conservative intervention (failure to improve within 30 days)	0.29	0.90	3.0 (1.4, 6.3)	0.79 (−0.58, 1.07)	...
	Unexplained weight loss	0.15	0.94	3.0 (1.0, 9.3)	0.87 (0.68, 1.12)	...
	No relief with bed-rest	1.00	0.46	1.7 (1.2, 2.2)	0.22 (0.02, 3.02)	...

(continued)


LOW BACK PAIN: CLINICAL PRACTICE GUIDELINES

Condition	History and Physical Examination Data	Sensitivity	Specificity	+LR (95% CI)	−LR (95% CI)	Odds Ratio (95% CI)
Cauda equina syndrome [9,84]	Urine retention	0.90	0.95	18.0	0.11	...
	Fecal incontinence	...	...	...	...	...
	Saddle anesthesia	0.75	...	...	...	...
	Sensory or motor deficits in the feet (L4, L5, S1 areas)	0.80	...	...	...	...
Back-related infection[44] [107]	Recent infection (eg, urinary tract or skin), intravenous drug user/abuser	0.40	...	...	...	...
	Concurrent immunosuppressive disorder	...	...	...	...	...
	Deep constant pain, increases with weight bearing	...	...	...	...	...
	Fever, malaise, and swelling	...	...	...	...	...
	Spine rigidity; accessory mobility may be limited	...	...	...	...	...
	Fever: tuberculosis osteomyelitis	0.27	0.98	13.5	0.75	...
	Fever: pyogenic osteomyelitis	0.50	0.98	25.0	0.51	...
	Fever: spinal epidural abscess	0.83	0.98	41.5	0.17	...
Spinal compression fracture[107]	History of major trauma, such as vehicular accident, fall from a height, or direct blow to the spine	0.30	0.85	12.8 (8.3, 18.7)	0.37 (0.20, 0.57)	...
	Age over 50	0.79	0.64	2.2 (1.4, 2.8)	0.34 (0.12, 0.75)	...
	Age over 75	0.59	0.84	3.7 (2.9, 4.5)	0.49 (0.37, 0.62)	...
	Prolonged use of corticosteroids	...	...	...	...	...
	Point tenderness over site of fracture	...	...	...	...	...
	Increased pain with weight bearing	...	...	...	...	...
Abdominal aneurysm (>4 cm)[27]	Back, abdominal, or groin pain	...	...	...	...	...
	Presence of peripheral vascular disease or coronary artery disease and associated risk factors (age over 50, smoker, hypertension, diabetes mellitus)	...	...	...	...	...
	Smoking history	...	...	...	...	5.07 (4.13, 6.21)
	Family history	...	...	...	...	1.94 (1.63, 2.32)
	Age over 70	...	...	...	...	1.71 (1.61, 1.82)
	Non-Caucasian	...	...	...	...	1.02 (0.77, 1.35)
	Female	...	...	...	...	0.18 (0.07, 0.48)
	Symptoms not related to movement stresses associated with somatic low back pain	...	...	...	...	...
	Abdominal girth <100 cm	0.91	0.64	2.5	0.14	...
	Presence of a bruit in the central epigastric area upon auscultation	...	...	...	...	...
	Palpation of abnormal aortic pulse	0.88	0.56	2.0	0.22	...
	Aortic pulse 4 cm or greater	0.72	...	...	...	...
	Aortic pulse 5 cm or greater	0.82	...	...	...	...

Lumbar Special Questions

- Previous Hx of CA
- Unexplained weight loss
- Night pain unrelieved with movement
- Bowel and bladder changes
  - Urinary retention
  - Bowel incontinence
- Saddle region anesthesia
- Recent infection
- Fever, malaise
- Hx of trauma
- Hx of corticosteroid use
- Hx bone disease
  - Osteopenia/porosis
- Pain with rigorous activity
- Hx Vascular disease
- Hx Connective tissue disorder
- Morning stiffness >60 minutes
- Additional aches and pains
  - Joints or tendons
- Eye symptoms

Documentation of Red Flags by Physical Therapists for Patients with Low Back Pain

Pamela J. Leerar, PT, DHSc, OCS, COMPT
William Boissonnault, PT, DHSc, FAAOMPT
Elizabeth Domholdt, PT, EdD, FAPTA
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The Journal of Manual & Manipulative Therapy
Vol. 15 No. 1 (2007), 42–49

TABLE 1. Red flags item description and rationale

Red Flag Item	Description	Rationale
Trauma	History of minor or major trauma, motor vehicle accident, fall, strenuous lifting	Possible fracture, especially in an older or osteoporotic patient
Age	50 years or more	Increased risk of cancer, abdominal aortic aneurysm, fracture, infection
History of cancer	Past or present history of any type of cancer	History of cancer increases the risk of cancer-causing low back pain. Back pain may be caused by metastic tumors arising from the kidney, thyroid, prostate, breast, lung
Fever, chills, night sweats	Fever over 100 degrees Fahrenheit, a sensation of being cold, waking up sweating, temperature changes at night	Constitutional symptoms may increase the risk of infection or cancer
Weight loss	Unexplained weight loss of over 10 pounds in 3 months, not directly related to a change in activity or diet	May be indicative of infection or cancer
Recent infection	Recent bacterial infection such as a urinary tract infection	Increases the risk of infection

TABLE 1. Red flags item description and rationale

Red Flag Item	Description	Rationale
Immunosuppression	Immunosuppresssion resulting from a transplant, intravenous drug abuse, or prolonged steroid use	Increases the risk of infection
Rest/night pain	Pain that is not relieved with rest or awakens a patient at night, unrelated to movement or positioning	Increases the risk of cancer, infection, or an abdominal aortic aneurysm
Saddle anesthesia	Absence of sensation in the second-fifth sacral nerve roots, the perianal region	Cauda equina syndrome
Bladder dysfunction	Urinary retention, changes in frequency of urination, incontinence, dysuria, hematuria	May indicate cauda equina syndrome or infection
Lower extremity neurological deficit	Progressive or severe neurological deficit in the lower extremity	May indicate cauda equina syndrome

ELSEVIER

Journal of Clinical Epidemiology 61 (2008) 110–118

Journal of Clinical Epidemiology

A systematic review identifies five "red flags" to screen for vertebral fracture in patients with low back pain

Nicholas Henschke*, Christopher G. Maher, Kathryn M. Refshauge

Back Pain Research Group, University of Sydney, PO Box 170, Lidcombe NSW 1825, Sydney, Australia

Accepted 20 April 2007

- 5 clinical features that should alert clinician of possible vertebral fracture
  - >50 yo
  - Female
  - Major Trauma
  - Palpable Tenderness
  - Distracting painful injury

ARTHRITIS & RHEUMATISM
Vol. 60, No. 10, October 2009, pp 3072–3080
DOI 10.1002/art.24853

Prevalence of and Screening for Serious Spinal Pathology in Patients Presenting to Primary Care Settings With Acute Low Back Pain

Table 5. Diagnostic rule to identify vertebral fracture*

	Criteria for a positive test		
	1 positive feature	≥2 positive features	≥3 positive features
Sensitivity, %	88	63	38
Specificity, %	50	96	100
Positive LR (95% CI)	1.8 (1.1–2.0)	15.5 (7.2–24.6)	218.3 (45.6–953.8)
Posttest probability of vertebral fracture, %			
Pretest probability 0.5%	1	7	52
Pretest probability 3%	5	32	87

* Four features were included in the rule: female sex, age >70 years, significant trauma (major in young patients, minor in elderly patients), and prolonged use of corticosteroids. LR = likelihood ratio; 95% CI = 95% confidence interval.

Table 2. Prevalence of serious spinal pathology among the 1,172 patients with acute low back pain presenting to a primary care setting

Pathology	No. of cases of confirmed pathology	Prevalence (95% CI)*
Spinal fracture	8	0.7 (0.4–1.3)
Cancer	0	0.0 (0.0–0.3)
Infection	0	0.0 (0.0–0.3)
Cauda equina syndrome	1	0.1 (0.0–0.5)
Inflammatory disorder	2	0.2 (0.1–0.6)
Total	11	0.9 (0.5–1.7)

* 95% CI = 95% confidence interval.

[Diagnostic Test Accuracy Review]

Red flags to screen for vertebral fracture in patients presenting with low-back pain

2013

THE COCHRANE COLLABORATION®

- Available evidence does not support the use of many "red flags" to help identify vertebral fractures in pts with LBP
  - Combining "red flags" helps to improve usefulness
  - Most useful were trauma, old age, corticosteroid use
- Reliance on subjective "red flags" may lead to excessive imaging leading to increased medical costs and unnecessary exposure to radiation

Red Flags: Skeletal Metastases to the Spine

- Most common in CA of the:
  - Breast
  - Prostate
  - Lung
  - Kidney
  - Thyroid
- CA of breast
  - Metastasize in 47% to 85% of cases
  - Spine is most common site
  - Lumbar vertebral body specifically

Red Flags: Skeletal Metastases to the Spine

- Clinical Features
  - Severe, incessant, pain
  - "Bone pain"
  - Other sources of pain
    - Nerve compression
    - Soft tissue involvement
    - Compression of viscera
  - Pathologic fracture

Condition	History and Physical Examination Data
Back-related tumor[82,84,148]	Constant pain not affected by position or activity; worse with weight bearing, worse at night
	Age over 50
	History of cancer
	Failure of conservative intervention (failure to improve within 30 days)
	Unexplained weight loss
	No relief with bed-rest

Eur Spine J (2007) 16:1673–1679
DOI 10.1007/s00586-007-0412-0

ORIGINAL ARTICLE

Screening for malignancy in low back pain patients: a systematic review

Nicholas Henschke · Christopher G. Maher · Kathryn M. Refshauge

In conclusion malignancy is rare in low back patients. The most informative tests to screen for malignancy are a previous history of cancer, overall clinician judgement, elevated ESR, and reduced hematocrit. Popular red flags such as unexplained weight loss, age >50, and failure to improve after 1 month have only modest predictive ability and on their own are not useful to screen for cancer.

[Diagnostic Test Accuracy Review]

Red flags to screen for malignancy in patients with low-back pain

2013

THE COCHRANE COLLABORATION®

Red flags to screen for malignancy and fracture in patients with low back pain: systematic review

BMJ 2013;347:

BMJ

Red Flags: Cauda Equina Syndrome

- Due to massive protrusion, herniation or mass, trauma (manipulation, lumbar puncture etc…)
- Signs and symptoms
  - Mild or severe back pain
  - Bilateral leg pain
  - Multi-segmental weakness, sensory loss, hyporeflexia
  - Saddle paresthesia
  - Bowel and/or bladder dysfunction
  - Sexual Dysfunction

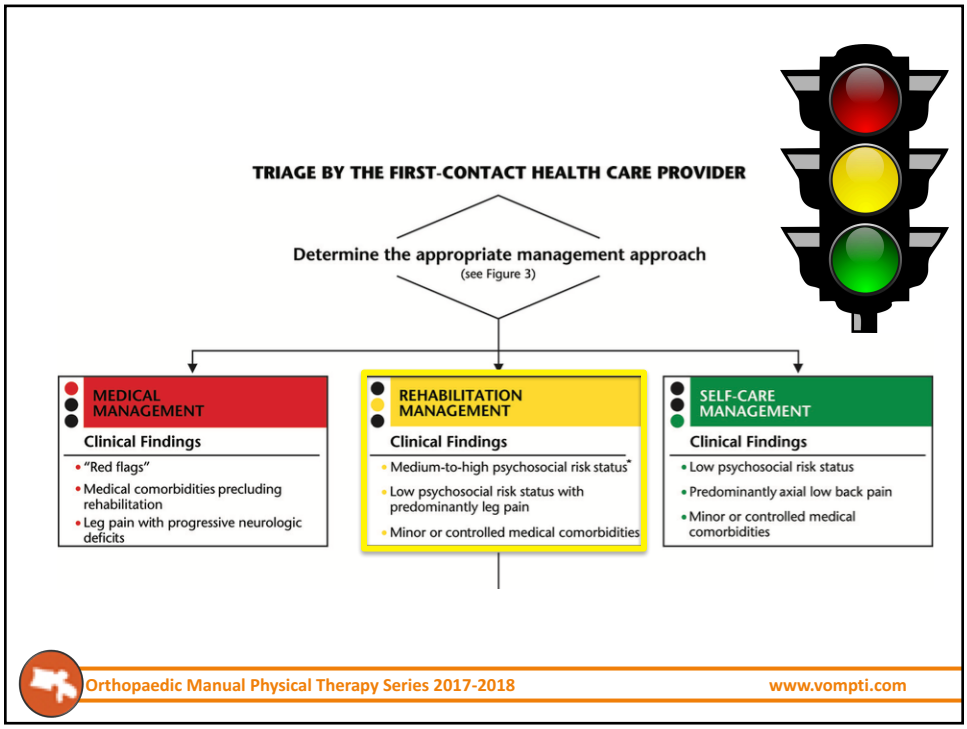
Condition	History and Physical Examination Data	Sensitivity	Specificity	+LR (95% CI)	-LR (95% CI)
Cauda equina syndrome [9,34]	Urine retention	0.90	0.95	18.0	0.11
	Fecal incontinence	…	…	…	…
	Saddle anesthesia	0.75	…	…	…
	Sensory or motor deficits in the feet (L4, L5, S1 areas)	0.80	…	…	…

Red Flags: Vascular Pain

- Vascular insufficiency or disease can refer to the back or present like referred or radicular pain from the lumbar spine into the lower extremity
  - Abdominal Aortic Aneurism (AAA) refers pain to lumbar spine
    - Risk factors for AAA
      - Cigarette smokers, men>women, >60yo, diabetes, arteriosclerosis, Ehlers-Danlos Syndrome, Marfans Syndrome
  - Intermittent Claudication
    - Activity increases pain, relieved with rest
      - Differentially diagnosed from stenosis with bike or inclined t-mill test

Red Flags: Spondyloarthropathies

Spondyloarthropathy	Disease Manifestation	Distribution of Arthritis	Extra-Articular Manifestations
Psoriatic arthritis	Psoriasis	Any small or large joint, including DIP joints , sacroiliitis common	Psoriatic pitting of nails common; eye inflammation
Arthritis of inflammatory bowel disease (enteropathic arthritis)	Crohn's disease, ulcerative colitis	Peripheral oligoarthritis, usually knees, ankles Unilateral sacoiliitis to extensive spondylitis	Eye inflammation, mouth ulcers, skin ulcers (pyoderma gangrenosum)
Reactive arthritis (including Reiter syndrome)	After urethritis or dysentery	Sacroiliitis, peripheral oligoarthritis predominantly of large joints of lower extremities, Achilles tendonitis	Eye inflammation urethritis, mouth ulcers, rash, penile rash
Ankylosing spondylitis	Primary spinal arthritis	Spinal and pelvic articulations and enthuse, including hips; occasional varying peripheral arthritis	Eye inflammation, aortitis with aortic murmur, lung fibrosis



Flag	Nature	Examples
Red	Signs of serious pathology	Cauda equina syndrome, fracture, tumor
Orange	Psychiatric symptoms	Clinical depression, personality disorder
Yellow	Beliefs, appraisals, and judgments	Unhelpful beliefs about pain: indication of injury as uncontrollable or likely to worsen Expectations of poor treatment outcome, delayed return to work
	Emotional responses	Distress not meeting criteria for diagnosis of mental disorder Worry, fears, anxiety
	Pain behavior (including pain coping strategies)	Avoidance of activities due to expectations of pain and possible reinjury Over-reliance on passive treatments (hot packs, cold packs, analgesics)
Blue	Perceptions about the relationship between work and health	Belief that work is too onerous and likely to cause further injury Belief that workplace supervisor and workmates are unsupportive
Black	System or contextual obstacles	Legislation restricting options for return to work Conflict with insurance staff over injury claim Overly solicitous family and health care providers Heavy work, with little opportunity to modify duties

Yellow Flags

Attitudes and Beliefs	Behaviors
- Belief that pain is harmful or disabling resulting in guarding and fear of movement. - Belief that all pain must be abolished before returning to activity - Expectation of increased pain with activity or work, lack of ability to predict capabilities - Catastrophizing, expecting the worst - Belief that pain is uncontrollable - Passive attitude to rehabilitation	- Use of extended rest - Reduced activity level with significant withdrawal from daily activities - Avoidance of normal activity and progressive substitution of lifestyle away from productive activity - Reports of extremely high pain intensity - Excessive reliance on aids (braces, crutches, etc.) - Sleep quality reduced following the onset of back pain - High intake of alcohol or other substances with an increase since the onset of back pain - Smoking

Childs, et al. 2003

STarT Back Tool

Thinking about the **last 2 weeks** tick your response to the following questions:

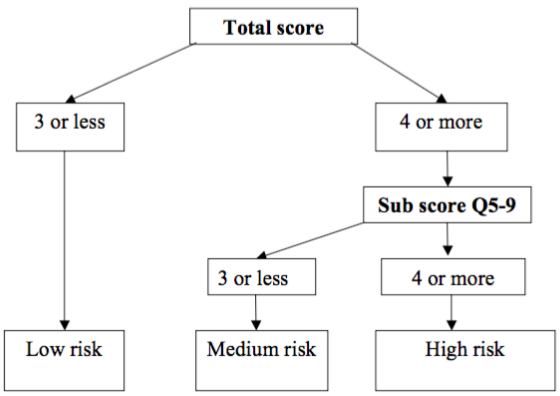
		Disagree 0	Agree 1
1	My back pain has **spread down my leg(s)** at some time in the last 2 weeks	☐	☐
2	I have had pain in the **shoulder** or **neck** at some time in the last 2 weeks	☐	☐
3	I have only **walked short distances** because of my back pain	☐	☐
4	In the last 2 weeks, I have **dressed more slowly** than usual because of back pain	☐	☐
5	It's not really safe for a person with a condition like mine to be physically active	☐	☐
6	**Worrying thoughts** have been going through my mind a lot of the time	☐	☐
7	I feel that **my back pain is terrible** and **it's never going to get any better**	☐	☐
8	In general I have **not enjoyed** all the things I used to enjoy	☐	☐

9. Overall, how **bothersome** has your back pain been in the **last 2 weeks**?

Not at all	Slightly	Moderately	Very much	Extremely
☐ 0	☐ 0	☐ 0	☐ 1	☐ 1

Total score (all 9): _____ **Sub Score (Q5-9):**_____

STarT Back Tool



Effect of Stratified Care for Low Back Pain in Family Practice (IMPaCT Back): A Prospective Population-Based Sequential Comparison

ANNALS OF FAMILY MEDICINE • WWW.ANNFAMMED.ORG • VOL. 12, NO. 2 • MARCH/APRIL 2014

- 3 Phases of the study
  - Phase 1 Usual Care
  - Phase 2 Implementation of Stratification Screening
  - Phase 3 Stratified Care
    - Low risk = advice, education and self management
    - Medium and high risk = physical therapy

Effect of Stratified Care for Low Back Pain in Family Practice (IMPaCT Back): A Prospective Population-Based Sequential Comparison

ANNALS OF FAMILY MEDICINE • WWW.ANNFAMMED.ORG • VOL. 12, NO. 2 • MARCH/APRIL 2014

- Phase 1
  - 40% of medium and high risk referred to PT
- Phase 3
  - 72% of medium and high risk referred to PT
- Decreased costs, disability, time off work, medication usage

Fear Avoidance Belief Questionnaire (FABQ)

- Comprised of 2 subscales:
  - 5-item scale related to fear-avoidance beliefs about physical activity
  - 11-item scale related to beliefs about work
- Valid and reliable in a chronic LBP population
- Clinical usefulness
  - Screening tool for identifying acute LBP patients who will not return to work by 4 weeks

Modified Oswestry Disability Index

LOW BACK DISABILITY QUESTIONNAIRE (REVISED OSWESTRY)

This questionnaire has been designed to give the doctor information as to how your back pain has affected your ability to manage in everyday life. Please answer every section and mark in each section only ONE box which applies to you. We realize you may consider that two of the statements in any one section relate to you, but please just mark the box which **MOST CLOSELY** describes your problem.

Section 1 - Pain Intensity

☐ I can tolerate the pain without having to use painkillers.
☐ The pain is bad but I can manage without taking painkillers.
☐ Painkillers give complete relief from pain.
☐ Painkillers give moderate relief from pain.
☐ Painkillers give very little relief from pain.
☐ Painkillers have no effect on the pain and I do not use them.

Section 2 -- Personal Care (Washing, Dressing, etc.)

☐ I can look after myself normally without causing extra pain.
☐ I can look after myself normally but it causes extra pain.
☐ It is painful to look after myself and I am slow and careful.
☐ I need some help but manage most of my personal care.
☐ I need help every day in most aspects of self care.
☐ I do not get dressed, I wash with difficulty and stay in bed.

Section 3 – Lifting

☐ I can lift heavy weights without extra pain.
☐ I can lift heavy weights but it gives extra pain.
☐ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example on a table.
☐ Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
☐ I can lift very light weights.
☐ I cannot lift or carry anything at all.

Section 4 – Walking

☐ Pain does not prevent me from walking any distance.
☐ Pain prevents me from walking more than one mile.
☐ Pain prevents me from walking more than one-half mile.
☐ Pain prevents me from walking more than one-quarter mile
☐ I can only walk using a stick or crutches.
☐ I am in bed most of the time and have to crawl to the toilet.

Section 5 -- Sitting

☐ I can sit in any chair as long as I like
☐ I can only sit in my favorite chair as long as I like
☐ Pain prevents me from sitting more than one hour.
☐ Pain prevents me from sitting more than 30 minutes.
☐ Pain prevents me from sitting more than 10 minutes.
☐ Pain prevents me from sitting almost all the time.

Scoring: Questions are scored on a vertical scale of 0-5. Total scores and multiply by 2. Divide by number of sections answered multiplied by 10. A score of 22% or more is considered significant activities of daily living disability.
(Score___ x 2) / (___ Sections x 10) = _____ %ADL

Section 6 – Standing

☐ I can stand as long as I want without extra pain.
☐ I can stand as long as I want but it gives extra pain.
☐ Pain prevents me from standing more than 1 hour.
☐ Pain prevents me from standing more than 30 minutes.
☐ Pain prevents me from standing more than 10 minutes.
☐ Pain prevents me from standing at all.

Section 7 -- Sleeping

☐ Pain does not prevent me from sleeping well.
☐ I can sleep well only by using tablets.
☐ Even when I take tablets I have less than 6 hours sleep.
☐ Even when I take tablets I have less than 4 hours sleep.
☐ Even when I take tablets I have less than 2 hours sleep.
☐ Pain prevents me from sleeping at all.

Section 8 – Social Life

☐ My social life is normal and gives me no extra pain.
☐ My social life is normal but increases the degree of pain.
☐ Pain has no significant effect on my social life apart from limiting my more energetic interests, e.g. dancing.
☐ Pain has restricted my social life and I do not go out as often.
☐ Pain has restricted my social life to my home.
☐ I have no social life because of pain.

Section 9 – Traveling

☐ I can travel anywhere without extra pain.
☐ I can travel anywhere but it gives me extra pain.
☐ Pain is bad but I manage journeys over 2 hours.
☐ Pain is bad but I manage journeys less than 1 hour.
☐ Pain restricts me to short necessary journeys under 30 minutes.
☐ Pain prevents me from traveling except to the doctor or hospital.

Section 10 – Changing Degree of Pain

☐ My pain is rapidly getting better.
☐ My pain fluctuates but overall is definitely getting better.
☐ My pain seems to be getting better but improvement is slow at the present.
☐ My pain is neither getting better nor worse.
☐ My pain is gradually worsening.
☐ My pain is rapidly worsening.

Comments_____

Reference: Fairbank, Physiotherapy 1981; 66(8): 271-3, Hudson-Cook, In Roland, Jenner (eds.), Back Pain New Approaches To Rehabilitation & Education. Manchester Univ Press, Manchester 1989: 187-204

38%

Oswestry Disability Index - Interpretation

0% to 20%: minimal disability:	The patient can cope with most living activities. Usually no treatment is indicated apart from advice on lifting sitting and exercise.
21%-40%: moderate disability:	The patient experiences more pain and difficulty with sitting, lifting and standing. Travel and social life are more difficult and they may be disabled from work. Personal care, sexual activity and sleeping are not grossly affected and the patient can usually be managed by conservative means.
41%-60%: severe disability:	Pain remains the main problem in this group but activities of daily living are affected. These patients require a detailed investigation.
61%-80%: crippled:	Back pain impinges on all aspects of the patient's life. Positive intervention is required.
81%-100%:	These patients are either bed-bound or exaggerating their symptoms.

Treatment-Based Classification System for Low Back Pain: Revision and Update

Physical Therapy Volume 96 Number 7

TRIAGE BY THE FIRST-CONTACT HEALTH CARE PROVIDER

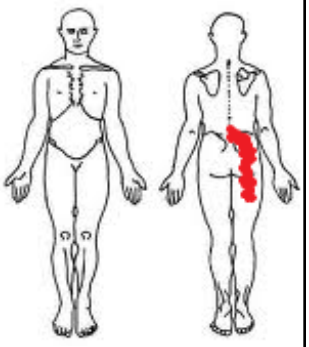
Determine the appropriate management approach
(see Figure 3)

MEDICAL MANAGEMENT	REHABILITATION MANAGEMENT	SELF-CARE MANAGEMENT
Clinical Findings	**Clinical Findings**	**Clinical Findings**
• "Red flags" • Medical comorbidities precluding rehabilitation • Leg pain with progressive neurologic deficits	• Medium-to-high psychosocial risk status* • Low psychosocial risk status with predominantly leg pain • Minor or controlled medical comorbidities	• Low psychosocial risk status • Predominantly axial low back pain • Minor or controlled medical comorbidities

SUBJECTIVE EXAM

Subjective *Asterisks* Signs/Symptoms: (Aggravating/Easing factors, Description/location of symptoms, Behavior, Mechanism of injury):

- 28yo female onset of right lower back and buttock pain/post thigh pain
- 2 weeks ago Immediate back pain while lifting her 2 year old off the floor. Buttock/thigh pain followed the next day
- LBP and buttock/thigh is an ache which is continuous
- Aggs: sitting, long periods of standing, lifting especially her child
- Eases: walking, lying down
- Pain is activity and positional dependent, occasionally awakes her at night, seems to worsen through the day



STRUCTURE at Fault:

Joints in/refer to the painful region	Myofascial tissue in/refer to the painful region	Non Contractile tissue in/refer to the painful region	Neural tissue in/refer to the painful region	Other structures that must be examined – non MSK
L4-S1 facets SIJ Hip	Lumbar multifidus Glute med/min, maxc Piriformis, hamstrings	L4-S1 disc Iliolumbar ligament Pelvis/Sacrum	L4-S1 nerve roots	Visceral? Spondyloar thropathy? Mass?

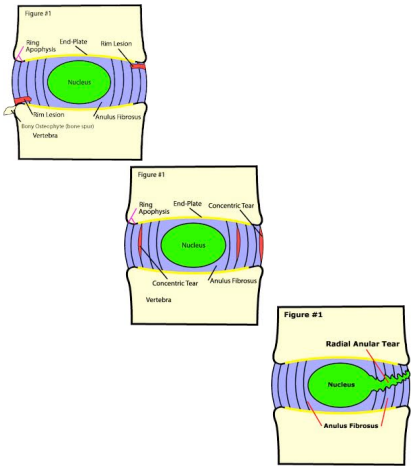
Primary HYPOTHESIS after Subjective Examination: L4-5/5-S1 disc pathology

Differential List (Rank/List in order to rule out):

L4-S1 facet
SIJ
Hip Pathology

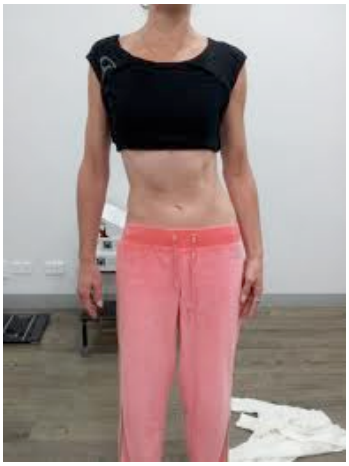
Discogenic Pain

- Rim lesion: tears to the outer layer of the annulus
- Circumferential tears: rupture of annular fibers between lamellae
- Radial tears: Fissures from nucleus to outer annular fibers
- Irritation of free nerve endings lead to referral to buttock and posterior thigh
  - Referral down the leg with dural tissue involvement



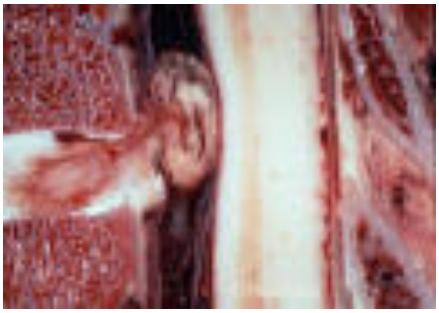
Lumbar Disc – Clinical Characteristics

- Protrusion/Prolapse/Annular tear
  - Young adult with history of a back injury
  - Pain in the back with possible referral to buttock and posterior thigh
  - Lateral deviation of the spine
    - Deviate away with posterolateral protrusion
    - Deviate towards with posteromedial protrusion
  - May or may not have neurological symptoms or radicular pain
  - Decreased WB through symptomatic LE if dural involvement
  - Aggravating factors include flexion postures and weight bearing postures



Lumbar Disc – Clinical Characteristics

- Extruded/Sequestered
  - Moderate to severe back and leg pain
    - Leg pain often worse than back pain
  - Lateral deviation with decreased weight bearing through symptomatic LE
  - Limited trunk movement
  - Radicular pain and radiculopathy likely



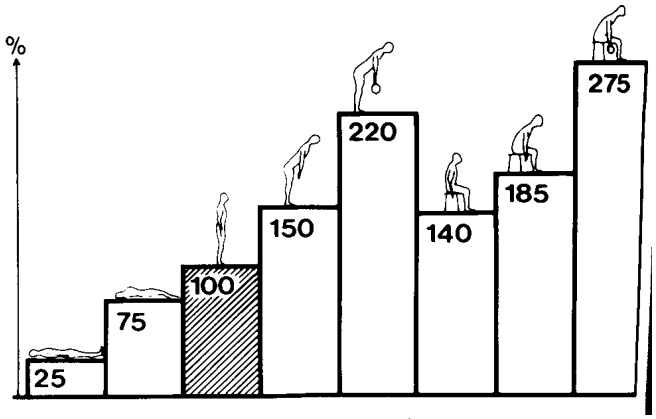
Lumbar Disc Pathology

Mechanism

- Typical position of injury is forward bent under load with some rotation
  - Forward bent position pushes annulus posterior and stresses posterior annulus
  - Load increases compression and increases stress on annulus
  - Rotation stresses 1/2 annular fibers that are already fully on tension

Lumbar Anatomy

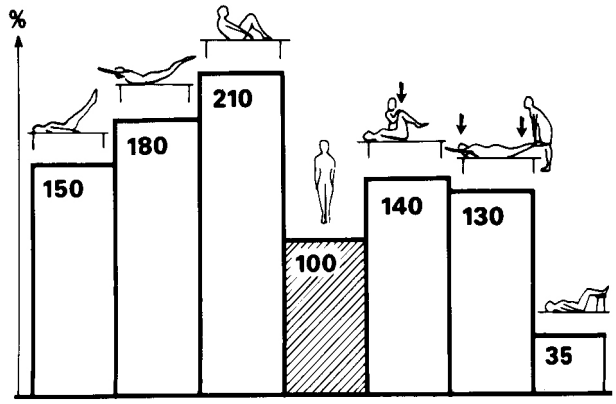
Intervertebral Disc



Comparative Loads on the Lumbar Discs

Lumbar Anatomy

Intervertebral Disc



Comparative Loads on the Lumbar Discs

Facet Joint Pain

- Joint surface or restraining tissues being strained (capsule/ligaments)
  - Innervated by medial branch of the dorsal rami
- Irritation leads to local back pain and referred pain
  - Typically referred into the buttock and posterior thigh
    - Referral down the leg if stimulus is strong enough

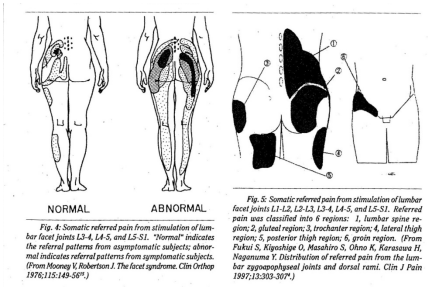


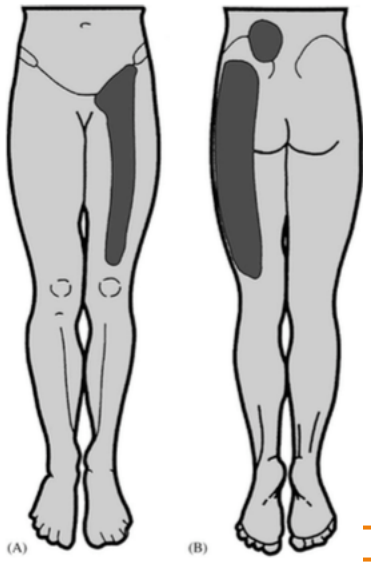
Fig. 4: Somatic referred pain from stimulation of lumbar facet joints L3-4, L4-5, and L5-S1. "Normal" indicates the referral patterns from asymptomatic subjects; abnormal indicates referral patterns from symptomatic subjects. (From Mooney V, Robertson J. The facet syndrome. Clin Orthop 1976;115:149-56[9].)

Fig. 5: Somatic referred pain from stimulation of lumbar facet joints L1-L2, L2-L3, L3-4, L4-5, and L5-S1. Referred pain was classified into 6 regions: 1, lumbar spine region; 2, gluteal region; 3, trochanter region; 4, lateral thigh region; 5, posterior thigh region; 6, groin region. (From Fukui S, Kiyoshige O, Masahiro S, Ohno K, Karasawa H, Nagaosuma Y. Distribution of referred pain from the lumbar zygoapophyseal joints and dorsal rami. Clin J Pain 1997;13:303-307[4].)

Original article

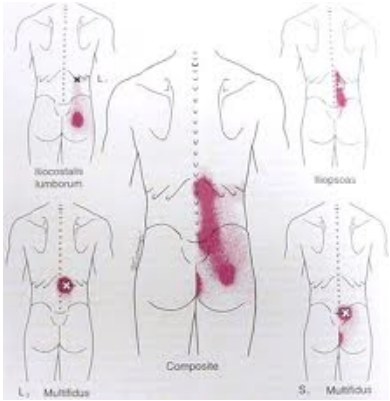
The lumbar multifidus muscle and patterns of pain

Manual Therapy 11 (2006) 40–45



Muscular Pain

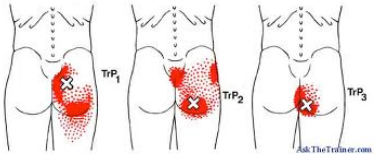
- Multifidus
- Erector spinae

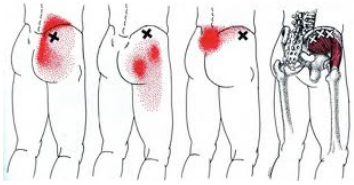


Travell & Simons

Muscular Pain

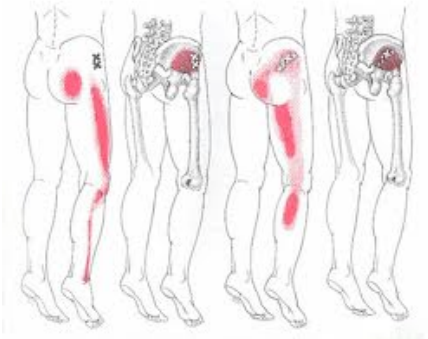
- Glute max
- Glute medius





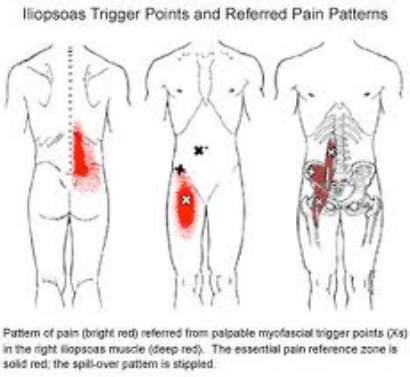
Muscular Pain

- Glute Minimus



Muscular Pain

- Iliopsoas



Pattern of pain (bright red) referred from palpable myofascial trigger points (Xs) in the right iliopsoas muscle (deep red). The essential pain reference zone is solid red; the spill-over pattern is stippled.

Lumbar Objective Examination

- Observation/Postural Assessment/Functional Testing
- Lumbar AROM/PROM/Resisted Testing
  - Quadrants
- SIJ Screening
- Neurological Testing
  - Segmental
  - Central
- Neurodynamic Testing
- Provocation Testing
  - PA, Compression, torsion
- Biomechanical Examination
  - Lumbar PPIVMs
  - Lumbar PAIVMs

Observation/Postural Assessment

- Observe in weight bearing and non-weight bearing and in multiple planes
  - Weight bearing
    - even/uneven
  - LE position
    - Knee flexed, hip ER?
  - Spinal alignment
    - Scoliosis
    - Lordosis/Kyphosis
    - Shifting
    - Deviation
  - Creases
  - Iliac crest height
  - Scars (injury, previous surgery)
  - Muscle tone (atrophy, spasm)

(+) Shift
Trunk to Left

Lumbar Objective Examination

- Observation/Postural Assessment/Functional Testing
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  - Quadrants
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- Neurological Testing
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- Provocation Testing
  - PA, Compression, torsion
- Biomechanical Examination
  - Lumbar PPIVMs
  - Lumbar PAIVMs

Lumbar AROM Assessment

- **Active Motion**: *assesses the patient's willingness to move and their perception of acuteness.*
  - Is the motion limited in a capsular pattern (extension, SB & rotation limited) or non-capsular pattern?
    - Flexion
    - Extension
    - Side bending
    - Seated rotation

Lumbar AROM Assessment

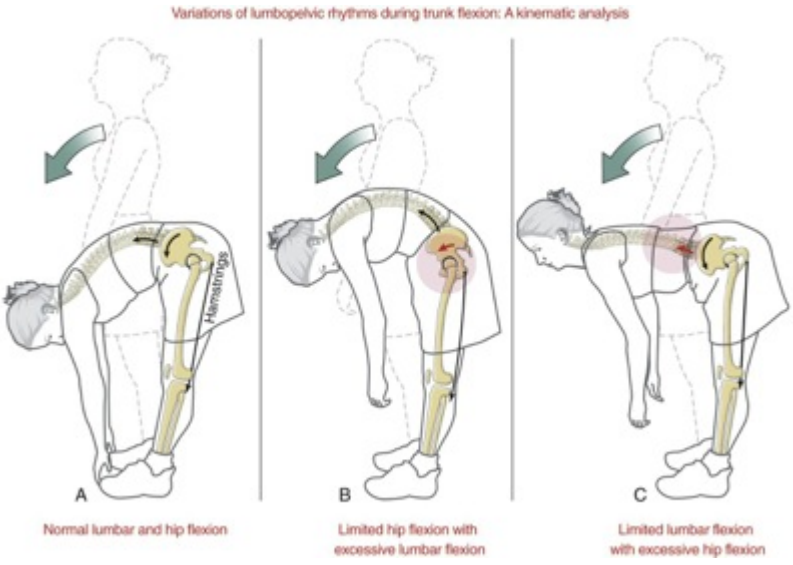
- **Active Motion**
  - Observe for aberrant motion
  - Does the movement reproduce "their pain"
  - Measurements??

Lumbar PROM Assessment

- **Passive Motion**: *passive over-pressure at the end of each active motion to assess end feel.*
  - Pain experienced prior, at or after resistance helps to determine acuity

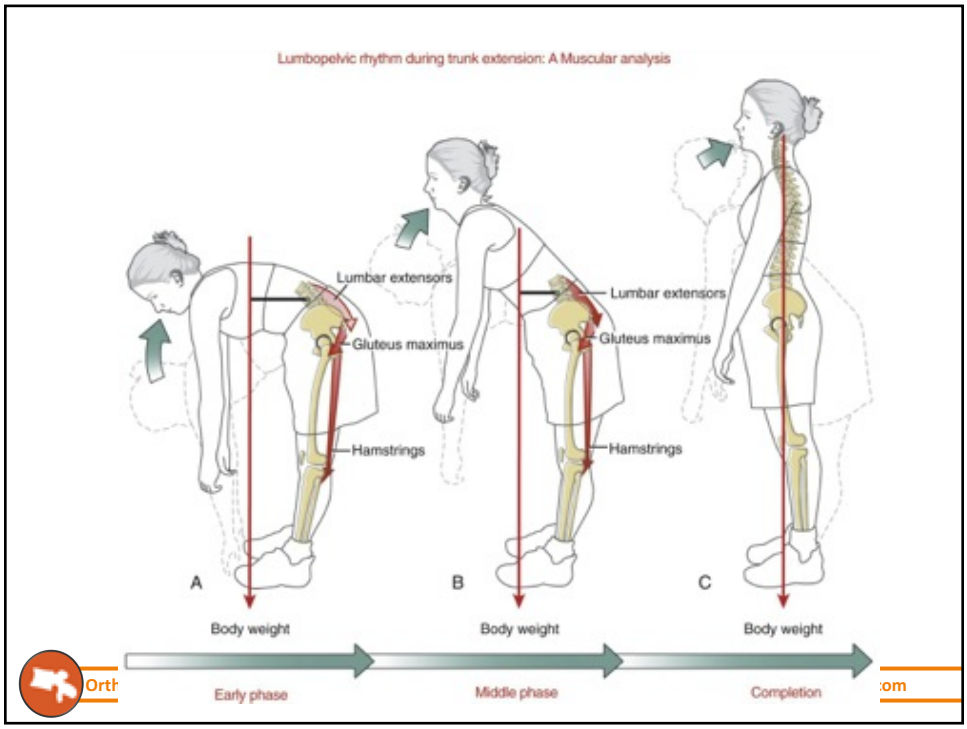
Lumbar Resisted Testing

- **Resisted Testing**: *tests muscles in lengthened position (if no pain with overpressure) otherwise test in neutral.*
  - Graded as painful/painless, weak/strong.



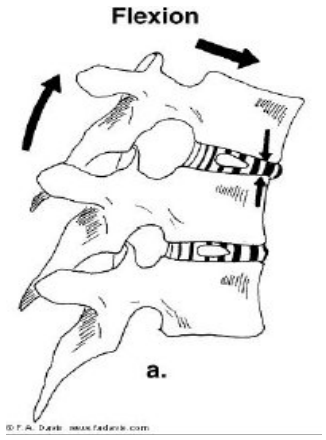
Lumbar ROM

- **Flexion**
  - Pt asked to bend forwards
    - Lordotic or flatness at L4-S1 at end of motion is normal except in dancers or gymnasts
  - Over-press at the end of motion by stabilizing the sacrum
    - End feel assessed
  - Isometric resistance assesses lumbar extensors



Lumbar ROM

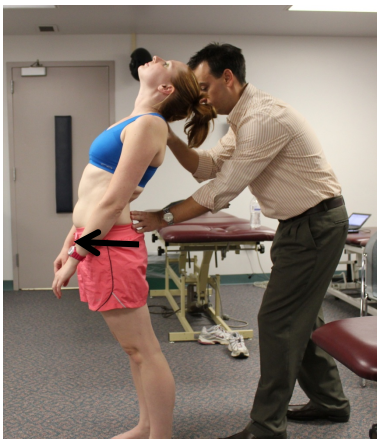
- Function During Forward Bending
  - Anterior annulus is compressed and posterior annulus is placed on tension
    - NP is pushed posteriorly
      - If another force is applied in forward bending, most of that force is directed to posterior annulus



(+)

Lumbar ROM

- **Extension**
  - Pt asked to bend backwards
  - Overpressure with caution
  - No resistance

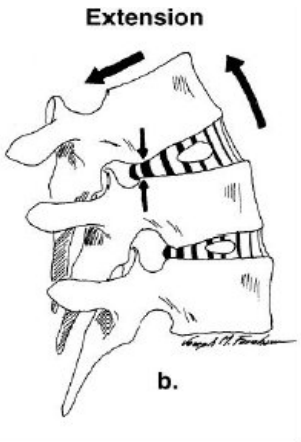


Lumbar ROM

- Function During Backward Bending
  - Posterior annulus is compressed and anterior annulus is placed on tension
    - NP is pushed anteriorly

(-)

REIS (+) for centralization

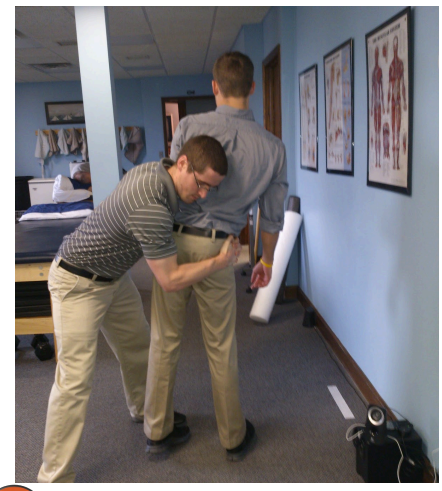


Lumbar ROM

L SB (+)

- **Side Bending**
  - Pt asked to bend side ways
    - Compare quantity and quality of movements to other side bend
  - Over-press at the end of motion by stabilizing the iliac crest
    - End feel assessed
  - Isometric resistance assesses contralateral SB's

Lumbar ROM – Pelvic Translocation



- Passive shift correction (overcorrection?)
- With ROM?
- Centralize/Peripheralize
- Relates to HEP

Lumbar ROM
Quadrant Testing

- **Quadrant Test**: *place the spine in the extreme combined movement. Performed when the cardinal planes have been negative or not reproduced all symptoms. May need to do this test to reproduce symptoms from a facet joint.*
  - Pt standing
  - Therapist guides patient in each quadrant and overpresses movement
    - Looking for reproduction of symptoms and movement asymmetry
    - Sustain and/or add compression at end of motion if needed

Front Right Quadrant

Back Right Quadrant

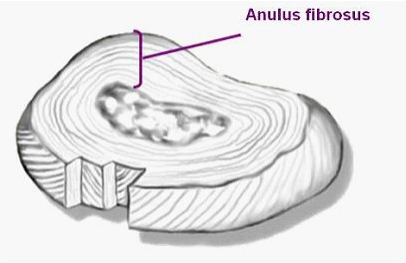
Lumbar ROM
Quadrant Testing

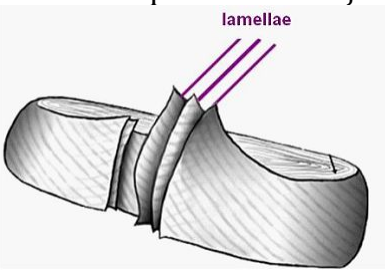
- Front Right Quadrant
  - Flexion/right SB/right rotation
    - Maximally flexes left facets
- Front Left Quadrant
  - Flexion/left SB/left rotation
    - Maximally flexes right facets
- Back Right Quadrant
  - Extension/right SB/right rotation
    - Maximally extends right facets
- Back Left Quadrant
  - Extension/left SB/left rotation
    - Maximally extends left facets

Lumbar Anatomy

Intervertebral Disc

- Function During Rotation
  - Rotation is resisted by 1/2 of the annular fibers (lamellae) depending on their fiber direction
    - Since only 1/2 of the fibers are able to resist the movement, rotation is a motion responsible for injury





Lumbar Objective Examination

- Observation/Postural Assessment/Functional Testing
- Lumbar AROM/PROM/Resisted Testing
  - Quadrants and H &I Testing
- SIJ Screening
- Neurological Testing
  - Segmental
  - Central
- Neurodynamic Testing
- Provocation Testing
  - PA, Compression, torsion
- Biomechanical Examination
  - Lumbar PPIVMs
  - Lumbar PAIVMs

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Manual Therapy 10 (2005) 207–218

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Original article

Diagnosis of Sacroiliac Joint Pain: Validity of individual provocation tests and composites of tests

Mark Laslett[a,*], Charles N. Aprill[b], Barry McDonald[c], Sharon B. Young[d]

- 6 SIJ tests
  - Distraction, Compression, Thigh Thrust, Gaenslen's left/right, Sacral Thrust
    - ****6 negative tests can rule out SIJ as source of pain****

Evidence-Based Diagnosis and Treatment of the Painful Sacroiliac Joint

Mark Laslett, FNZCP, PhD, Dip MT, Dip MDT

THE JOURNAL OF MANUAL & MANIPULATIVE THERAPY ■ VOLUME 16 ■ NUMBER 3

TABLE 1. Comparison between Laslett M et al[51] and van der Wurff et al[20] studies of the validity of multiples of positive pain provocation SIJ tests.

Diagnostic accuracy statistic	Number of positive provocation SIJ tests									
	1 or more		2 or more		3 or more		4 or more		5 or more	
	ML	PvW	ML	PvW	ML	PvW	ML	PvW	ML	PvW
Sensitivity %	100	100	93	93	91	85	50	26	27	0
Specificity %	44	42	66	58	78	79	81	82	88	100
Positive LR	1.8	1.7	2.7	2.2	4.3	4.0	3.2	1.4	2.1	0
Negative LR	0.0	0.0	0.10	0.13	0.08	0.19	0.49	0.91	0.84	1.00

**** 3 or More +, Rule In****

(-)

Fig. 2. Distraction provocation SIJ test.

Fig. 3. Thigh thrust SIJ provocation test.

Fig. 6. Sacral thrust provocation SIJ test.

Fig. 4. Gaenslen's provocation SIJ test (right sided test).

Fig. 5. Compression provocation SIJ test.

Lumbar Objective Examination

- Observation/Postural Assessment/Functional Testing
- Lumbar AROM/PROM/Resisted Testing
  - Quadrants
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Lumbar Neurological Testing

- **Key Muscle Testing**: *muscles predominately innervated by 1 nerve root. A maximal contraction is forced and if weakness is felt the test is repeated several times to test fatigueability. Myelopathy will lead to multi-segmental fatigueable weakness, radiculopathy will lead to segmental fatigueable weakness, neuropathy will lead to fatigueable weakness in the muscles innervated by that nerve.*
  - L2: Psoas (hip flexion)
  - L3: Quad (knee extension), Hip Adductors
  - L4: Tib ant (ankle DF), Tib post (ankle inversion)
  - L5: EHL (big toe extension), glute med (hip abduction)
  - L5/S1: Peroneals (ankle eversion)
  - S1: Gastroc (heel raises)
  - S2: Hamstrings (knee flexion), Glute max (hip extension)

Lumbar Neurological Testing

- **Sensation:** *tested with light touch and followed with sharp touch if light touch is positive. A radiculopathy will cause segmental anesthesia or hypoesthesia, a myelopathy will cause multi-segmental paresthesia or hypoesthesia, a neuropathy will cause anesthesia in a cutaneous distribution.*
  - Light touch performed down the entire leg with a dab of tissue paper
  - Sharp touch performed in dermatomal or peripheral nerve pattern where light touch was positive

Lumbar Neurological Testing

- **Reflexes**: *hypo-reflexia is due to lower motor neuron lesion, hyper-reflexia is due to upper motor neuron lesion.*
  - L3: Patella tendon or hip adductors
  - L4: Tibialis posterior or anterior
  - L5: Medial hamstrings, peroneals or EDB muscle belly
  - S1/2: Achilles or lateral hamstrings

(-)

Lumbar Neurological Testing

- **Upper Motor Neuron Test**
  - **Clonus**
    - Pt supine, give rapid push into ankle DF
    - 1-2 beats is normal
    - 3-4 beats is positive
  - **Babinski**
    - Make an "L" shape up the bottom of the foot with end of reflex hammer
    - Toe flexion is normal
    - Toe extension and flare is positive
  - **Hoffman's**
    - Pt's nail of the 3rd digit is "flicked"
    - IP flexion of the thumb is positive

Lumbar Objective Examination

- Observation/Postural Assessment/Functional Testing
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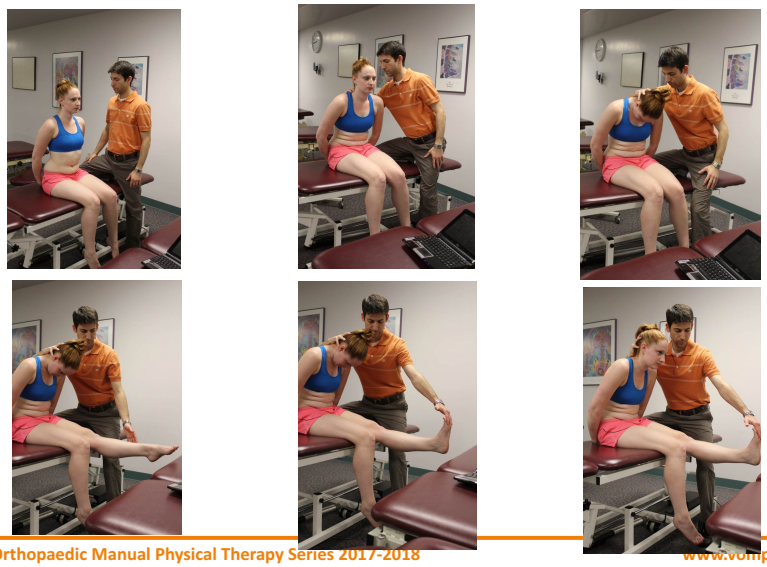
Lumbar Neurodynamic Testing

- Slump
- Long-Sit/Sympathetic Slump
- Straight Leg Raise
  - Peripheral Nerve Bias
- Prone Knee Bend

Slump Test (+)



Straight Leg Raise (+)

Prone Knee Bend Test/Femoral Nerve Test/Ely's Test

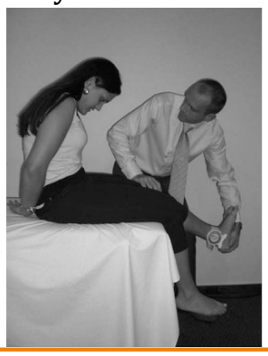
(-)

Agreement and Correlation Between the Straight Leg Raise and Slump Tests in Subjects With Leg Pain

Journal of Manipulative and Physiological Therapeutics
Volume 32, Number 3

Jeremy Walsh, MManipTher,[a] and Toby Hall, MSc[b,c]

- Substantial agreement b/w SLR and Slump (K = 0.69)
  - ROM in both significantly reduced vs opp side
- Appropriate test of mechanosensitivity for neural tissue



The Sensitivity and Specificity of the Slump and the Straight Leg Raising Tests in Patients With Lumbar Disc Herniation

JCR: Journal of Clinical Rheumatology • Volume 14, Number 2, April 2008

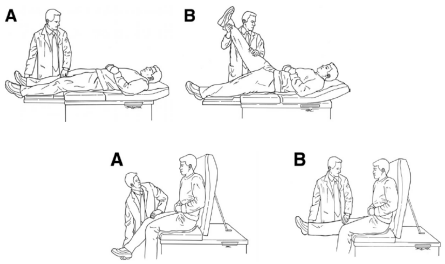
Javid Majlesi, MD, Halit Togay, MD,† Halil Ünalan, MD,‡ and Sadık Toprak, MD§*

- Slump
  - Sensitivity = 0.84
  - Specificity = 0.83
- SLR
  - Sensitivity = 0.52
  - Specificity = 0.89
- Slump used more to R/O
- SLR may especially help ID pts who have herniations with root compression requiring surgery

The Sensitivity of the Seated Straight-Leg Raise Test Compared With the Supine Straight-Leg Raise Test in Patients Presenting With Magnetic Resonance Imaging Evidence of Lumbar Nerve Root Compression Arch Phys Med Rehabil Vol 88, July 2007

Alon Rabin, DPT, MS, Peter C. Gerszten, MD, MPH, Pat Karausky, RN, BSN, Clareann H. Bunker, PhD, Douglas M. Potter, PhD, William C. Welch, MD

- Sensitivity:
  - Supine SLR 0.67
  - Seated SLR 0.41



- Traditional testing in supine is more sensitive in reproducing leg pain than the seated SLR in patients presenting with s/s of lumbar radiculopathy and (+) MRI

Upper Limb Neural Tension and Seated Slump Tests: The False Positive Rate among Healthy Young Adults without Cervical or Lumbar Symptoms

D. Scott Davis, PT, EdD, OCS[1], Ila Beth Anderson, MPT[2], Mary Grace Carson, MPT[2], Caroline L. Elkins, MPT[2], Lindsey B. Stuckey, MPT[2]

THE JOURNAL OF MANUAL & MANIPULATIVE THERAPY ■ VOLUME 16 ■ NUMBER 3

- 28/84 asymptomatic had (+) SST at some point in the available range of knee extension
  - Relief of peripheral neural symptoms with cervical extension
- Mean knee extension angle for (+) was 15.1
- Authors suggest that criteria be determined for (+) test using ROM cut-off scores

Lumbar Objective Examination

- Observation/Postural Assessment/Functional Testing
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  - Lumbar PAIVMs

Provocation Testing: Heel Drop Test

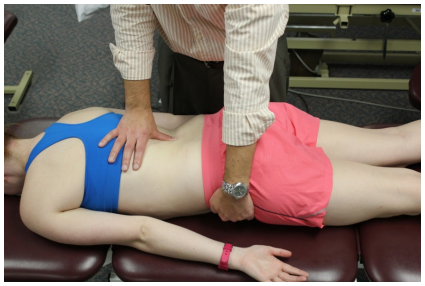
- **Compression:** *may identify disc lesions, end plate or vertebral body fractures, by increasing intra-vertebral or intra-discal pressure.*

- Pt standing
  - Patient asked to raise up on their toes and drop down quickly onto their heels
    - The test will add compression and vibration to the spine
    - Positive test is reproduction of the pt's pain

(-)

Provocation Testing: Torsion Test

- **Torsion Test**: Tests the lumbar spines ability to tolerate torsional stress
  - *May identify fractures, annular tears, joint capsule inflammation through rotation of the spine from below*
- Therapist stands to one side of the bed and stabilizes lower T-spine with cranial hand
- Therapist caudal hand grasps opposite ilium and pulls superior

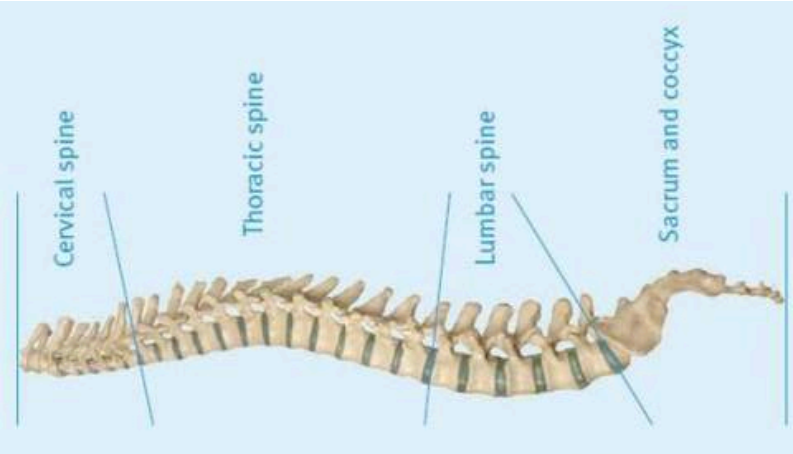


(+)

Provocation Testing: PA Shear Testing (+)

- **P/A Shearing**: Tests the ability of the lumbar spine to tolerate shear stress
  - *Testing for segment inflammation, mobility or "instability"*
  - Helps to localize segmental dysfunction
  - Pain provoking
  - Neutral Zone assessment
- Central
- Unilateral

Contours of the Spine



Lumbar Objective Examination

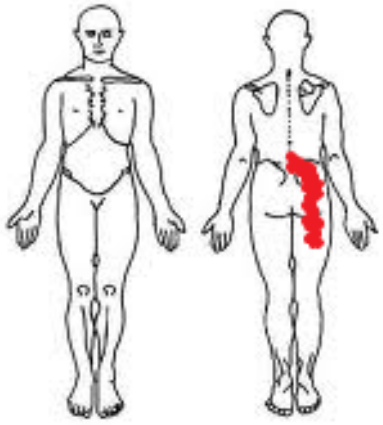
- Observation/Postural Assessment/Functional Testing
- Lumbar AROM/PROM/Resisted Testing
  - Quadrants
- SIJ Screening
- Neurological Testing
  - Segmental
  - Central
- Neurodynamic Testing
- Provocation Testing
  - PA, Compression, torsion
- Biomechanical Examination
  - Lumbar PPIVMs
  - Lumbar PAIVMs

Physical Exam *Asterisks* Signs/Symptoms (Special tests, Movement/Joint Dysfunction, Posture, Palpation, etc)

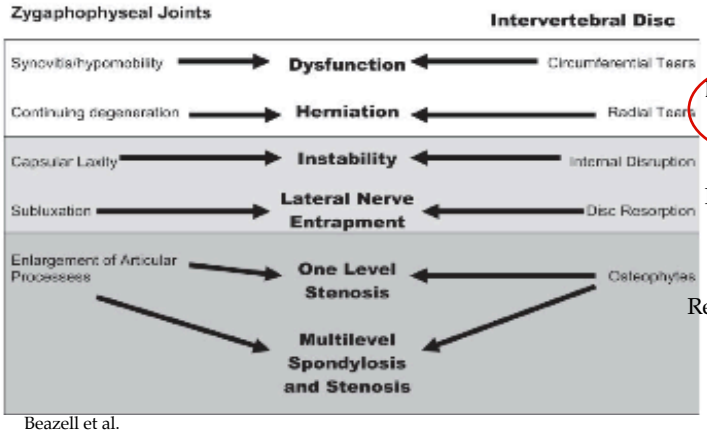
- Observation: Slight lateral shift to the left
- Lumbar ROM: P! lumbar flexion, lumbar L SB limited and P! reproducing LBP, Repeated extension centralized LBP
- (+) Torsion L4-5
- (+) SLR and slump reproducing buttock and posterior thigh pain
- (-) hip and SI clearing
- (+) PA right L4-5 P!
- Oswestry Disability Index = 38% perceived disability
- Biomechanical Exam: ROM limited but not due to articular restriction (see case 2)
  - (+) PPIVMs L4-5 into left SB
  - (-) PAIVM's

- Are the relationships between the areas on the body chart, the interview, and physical exam consistent? "Do the features fit" a recognizable clinical pattern? **Yes** **No**

Lumbar disc pathology (annular tear/bulge) with dural irritation



Phases of Degeneration



Beazell et al.

- What is your primary treatment Objective after initial evaluation?
  - **Education:** PT diagnosis and prognosis, addressing patient goals, questions and concerns, treatment expectations
  - **Manual Therapy:** (Specific Technique)
    PA mobilizations L4-5, manual distraction, nerve gliding
  - **Exercise Prescription:** (Specific)
    Repeated movements, lateral shifting correction, squatting maintaining lordosis, extension biased exercises, progressing from NWB to standing to sitting

What are you going to re assess at subsequent visit? ROM, provocation testing, neurodynamics

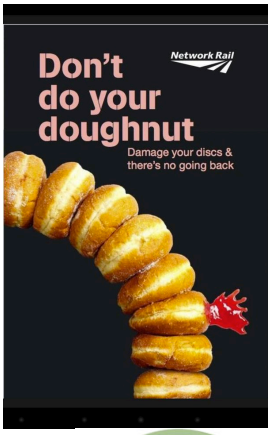
The Therapeutic Alliance Between Clinicians and Patients Predicts Outcome in Chronic Low Back Pain

Physical Therapy Volume 93 Number 4 April 2013

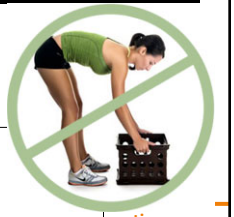
- 3 components of therapeutic alliance
  - PT /pt agreement on goals
  - PT/pt agreement on interventions
  - PT/pt affective bond
- Higher levels of therapeutic alliance was associated with better clinical outcomes with pts with LBP

Lumbar MR Imaging and Reporting Epidemiology: Do Epidemiologic Data in Reports Affect Clinical Management?[1]

McCullough et al, Radiology 2012



- Prevalence of MRI findings in people without back pain:
  - Disc degeneration 91%
  - Disc height loss 56%
  - Disc bulges 64%
  - Disc protrusion 32%
  - Annular Tears 38%



Radiological imaging for LBP results in:
- poorer health outcomes
- poor perceived prognosis
- more likely to have surgery (Sloan & Walsh 2010)

How Do We Communicate This?

Jarvick, 2005, Spine

- The strongest predictor for LBP was depression not MRI findings (2.3x)
- Annular tears, disc degeneration and facet joint arthrosis did not predict LBP
- No relationship between MRI findings and pain/disability
- Our language: Hurtful or Helpful?

Stuart McGill PhD showed that the lumbar disc material can herniate through the outer layer (annulus fibrosus) in as little as 20,000 repetitions of forward flexion or twisting through the lumbar spine. ***It is unlikely to cause a disc herniation if you bend backwards or sideways. Stooping, sitting, and bending at the waist are causes of disc herniation and subsequently back or leg pain.***

- **What is your primary treatment Objective after initial evaluation?**
  - **Education:** **PT diagnosis and prognosis, addressing patient goals, questions and concerns, treatment expectations**
  - **Manual Therapy:** (Specific Technique)

    PA mobilizations L4-5, manual distraction, nerve gliding
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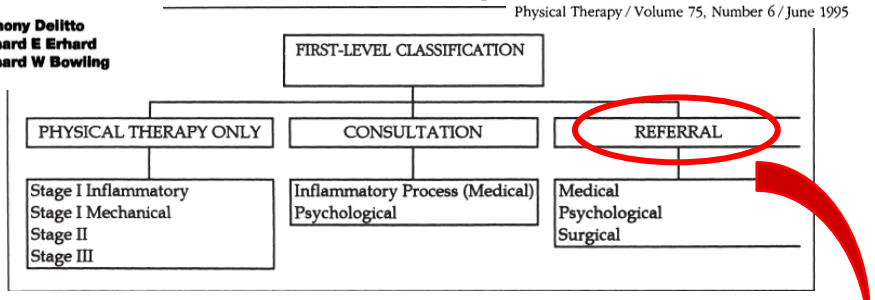
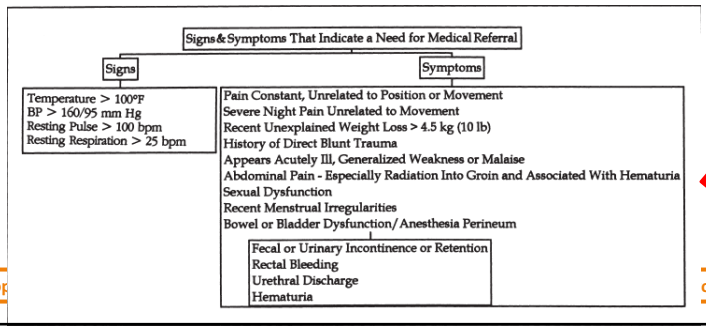
Classification Begins (1995)

Anthony Delitto
Richard E Erhard
Richard W Bowling

Physical Therapy / Volume 75, Number 6 / June 1995



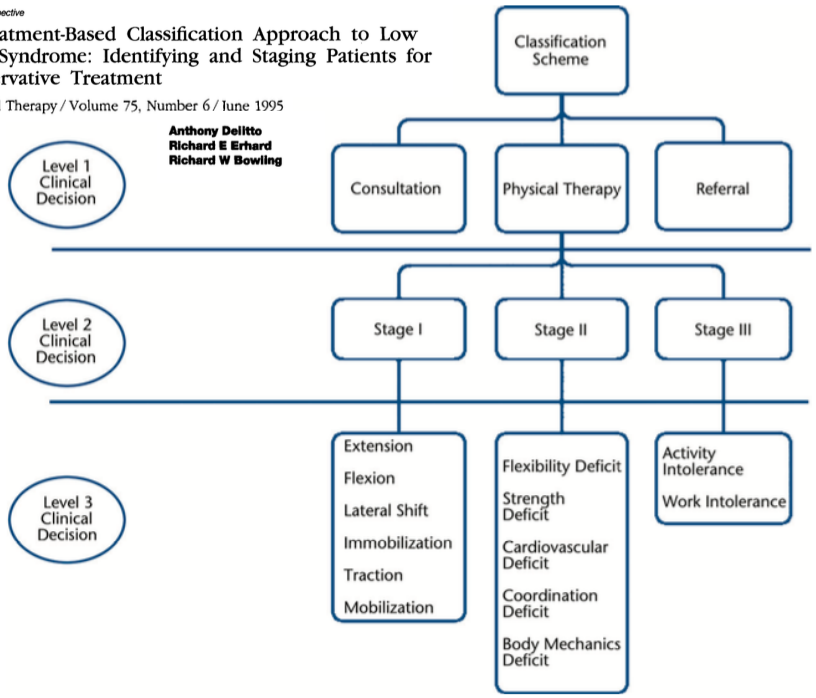


Clinical Perspective

A Treatment-Based Classification Approach to Low Back Syndrome: Identifying and Staging Patients for Conservative Treatment

Physical Therapy / Volume 75, Number 6 / June 1995

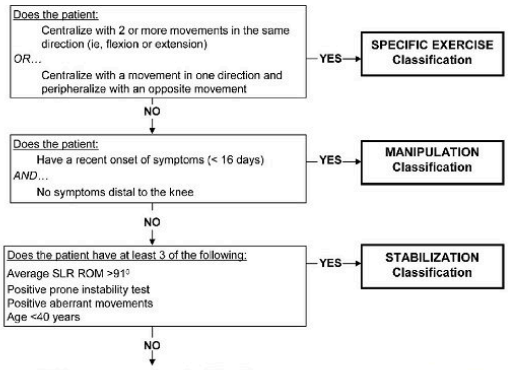
Anthony Delitto
Richard E Erhard
Richard W Bowling



Identifying Subgroups of Patients With Acute/Subacute "Nonspecific" Low Back Pain

Results of a Randomized Clinical Trial

SPINE Volume 31, Number 6, pp 623–631



Which sub-group does the patient fit best?

Brennan et al 2006

MANIPULATION		STABILIZATION		SPECIFIC EXERCISE	
Factors favoring	Factors against	Factors favoring	Factors against	Factors favoring	Factors against
More recent onset of symptoms Segmental hypomobility LBP only (no distal symptoms) Low FABQ scores (FABQW <19)	Symptoms below the knee Increasing episode frequency Peripheralization with motion testing No pain with mobility testing	Younger age Positive prone instability test Aberrant motions present Greater SLR ROM Hypermobility with spring testing Increasing episode frequency 3 or more prior episodes	Discrepancy in SLR ROM (>10°) Low FABQ scores (FABQPA < 9)	Strong preference for sitting or walking Centralization with motion testing Peripheralization in direction opposite centralization	Low back pain only (no distal symptoms) Status Quo with all movements

Classification of ***ACUTE/Sub-Acute*** Low Back Pain

[CLINICAL COMMENTARY]

JULIE M. FRITZ, PT, PhD, ATC[1] • JOSHUA A. CLELAND, PT, PhD, OCS, FAAOMPT[2] • JOHN D. CHILDS, PT, PhD, MBA, OCS, FAAOMPT[3]

Subgrouping Patients With Low Back Pain: Evolution of a Classification Approach to Physical Therapy

TABLE 1 Signs and Symptoms Originally Proposed as the Criteria for Placing a Patient Into a Particular Classification and Revised Criteria Based on Updated Evidence

Classification	Original Classification Criteria	Updated Classification Criteria
Manipulation	• Asymmetrical lateral flexion ROM (ie, capsular pattern of motion restriction) • Unilateral LBP without symptoms into the lower extremities • Asymmetrical bony landmarks of the pelvis • Positive sacroiliac dysfunction tests (ie, supine long sit test, prone knee bend test, standing flexion test)	• No symptoms distal to the knee • Recent onset of symptoms (<16 d) • Low FABQW score (<19) • Hypomobility of the lumbar spine • Hip internal rotation ROM (>35° for at least 1 hip)
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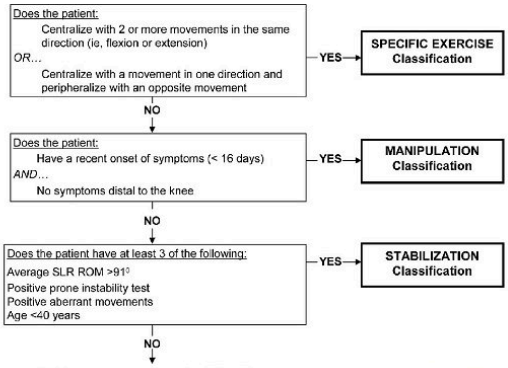
Specific exercise		
Extension	• Symptoms centralize with lumbar extension • Symptoms peripheralize with lumbar flexion	• Symptoms distal to the buttock • Symptoms centralize with lumbar extension • Symptoms peripheralize with lumbar flexion • Directional preference for extension
Flexion	• Symptoms centralize with lumbar flexion • Symptoms peripheralize with lumbar extension • Diagnosis of lumbar spinal stenosis	• Older age (>50 y) • Directional preference for flexion • Imaging evidence of lumbar spinal stenosis
Lateral shift	• Visible frontal plane deviation of the shoulders relative to the pelvis • Asymmetrical side-bending active ROM • Painful and restricted extension active ROM	• Visible frontal plane deviation of the shoulders relative to the pelvis • Directional preference for lateral translation movements of the pelvis
Traction	• Signs and symptoms of nerve root compression • No movements centralize symptoms	• Signs and symptoms of nerve root compression • No movements centralize symptoms

Abbreviations: ASLR, active straight-leg raise; FABQW, Fear-Avoidance Beliefs Questionnaire-Work Subscale; LBP, low back pain; ROM, range of motion; SLR, straight-leg raise.

What Was Classification Missing?



Brennan et al 2006

MANIPULATION		STABILIZATION		SPECIFIC EXERCISE	
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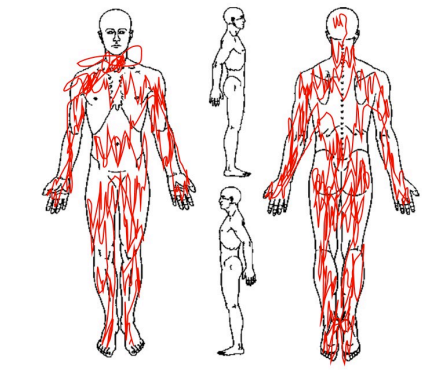
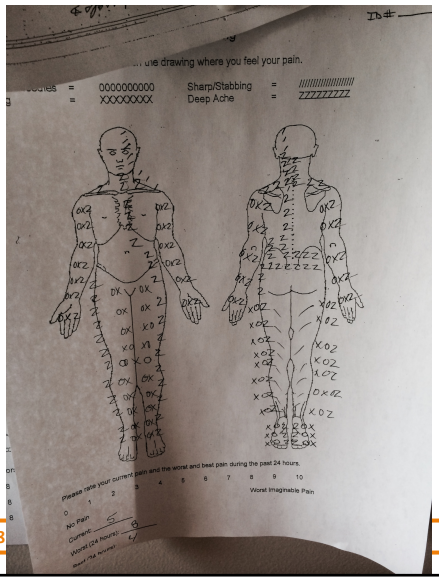
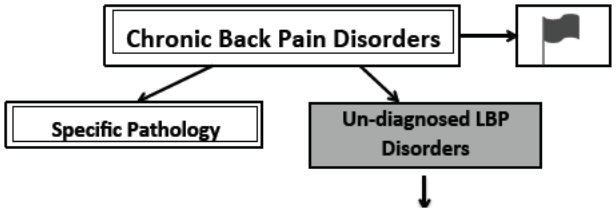
Classify This?



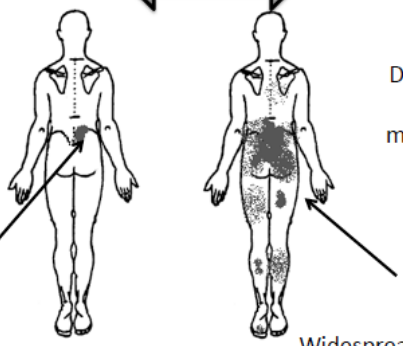


CHRONIC Low Back Pain Diagnosis



Persistent Back Pain
Model Borrowed from O'Sullivan

Mechanical CNSLBP — MIXED — **Non-Mechanical CNSLBP**



Clear Mechanical Behaviour to Disorder

Clear Anatomical Origin to Disorder

Movement hypersensitivity

Linked to posture, loading, movement control, activity, sleep problems, stress

Disproportionate response to mechanical stress

NO Clear Anatomical Origin to Disorder

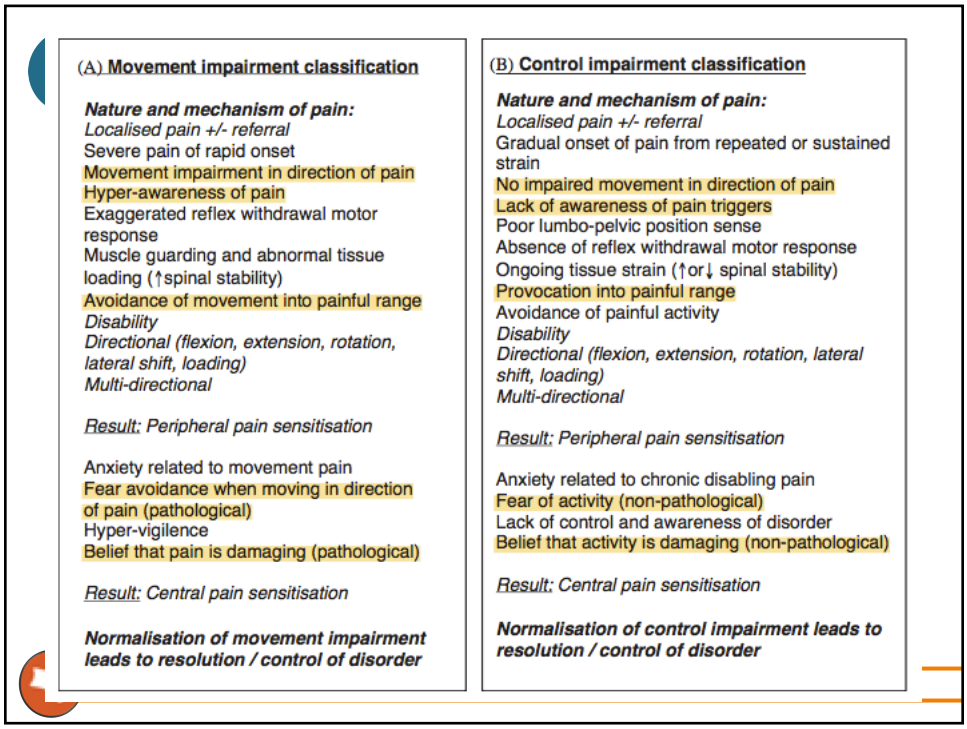
Widespread hypersensitivity to cold
Pressure hyperalgesia

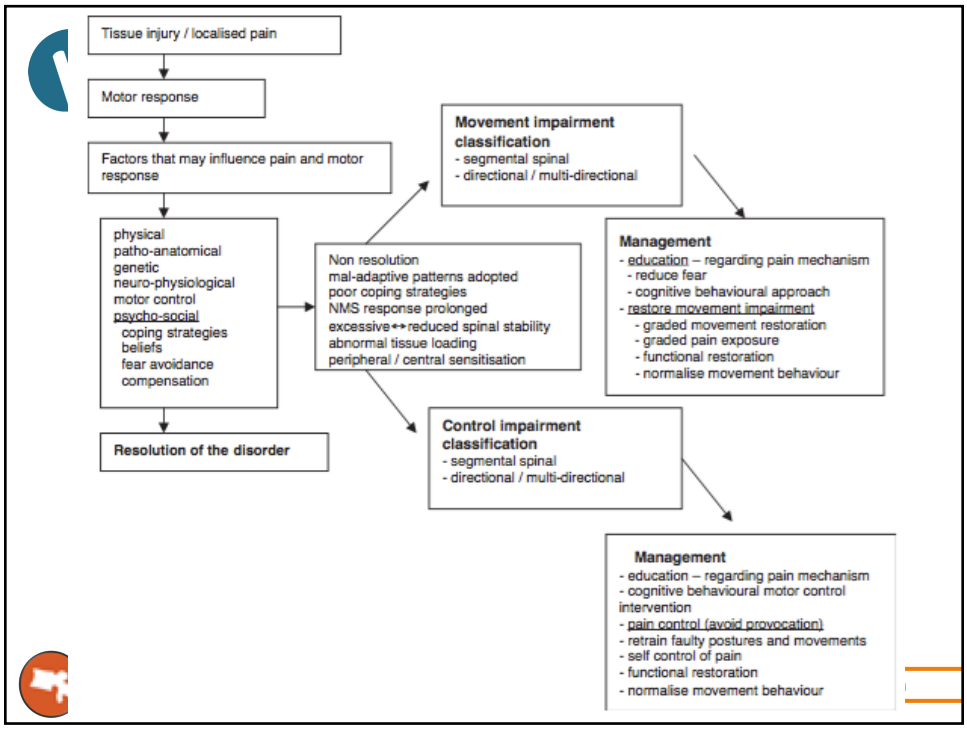
⇧anxiety, depression, catastrophising
stress, sleep problems

Masterclass

Diagnosis and classification of chronic low back pain disorders: Maladaptive movement and motor control impairments as underlying mechanism

Manual Therapy 10 (2005) 242–255





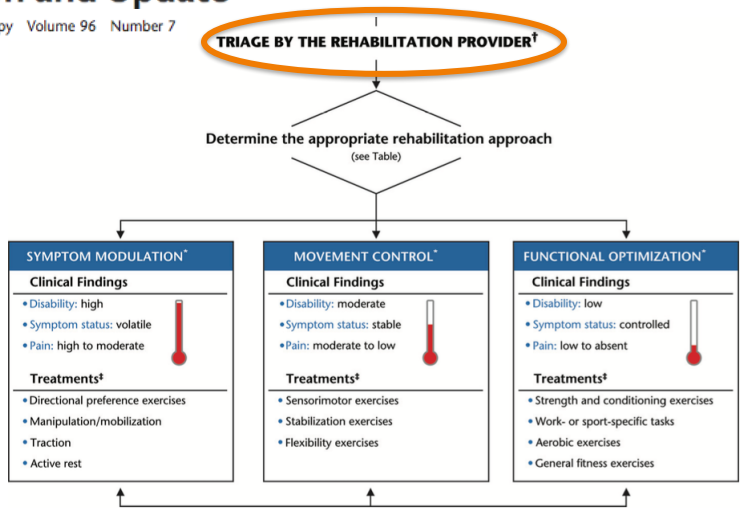
"Pain" Subgroup?
Fear and Catastrophization

- Well established that cognitions and pain are inter-related
- Patient's beliefs
  - What do they KNOW about their pain?
  - What do they WANT TO KNOW about their pain?
  - What do YOU WANT them to know about their pain?
- Qualitative studies show patients like this want answers to the following:
  - What is wrong with me?
  - How long will it take?
  - What can I (the patient) do?
  - What can you (the PT) do?
  - How much will it cost me?
- To treat patients like this we much change cognitions, belief and fear, before engaging a movement-based approach of therapeutic exercise, manual therapy, pacing and graded exposure
- This cognitive restructuring is done via TNE
  - Therapeutic Neuroscience Education
- Pain is a multiple system OUTPUT activated by the brain based on perceived threat (Moseley)

"What we think, we become."
Buddha

Treatment-Based Classification System for Low Back Pain: Revision and Update

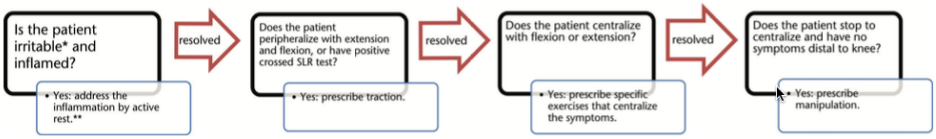
Physical Therapy Volume 96 Number 7



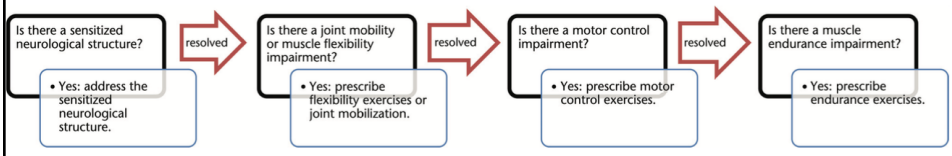
Treatment-Based Classification System for Low Back Pain: Revision and Update

Physical Therapy Volume 96 Number 7

Symptom Modulation



Movement Control



What About Classification?

[CLINICAL COMMENTARY]

JULIE M. FRITZ, PT, PhD, ATC[1] • JOSHUA A. CLELAND, PT, PhD, OCS, FAAOMPT[2] • JOHN D. CHILDS, PT, PhD, MBA, OCS, FAAOMPT[3]

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| JUNE 2007 | VOLUME 37 | NUMBER 6 | JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY

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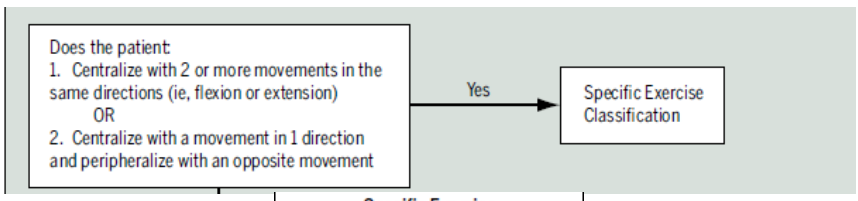

Specific Exercise

Factors Favoring	Factors Against
• Strong preference for sitting or walking • Centralization with motion testing • Peripheralization in direction opposite centralization	• LBP only (no distal symptoms) • Status quo with all movements

SPINE Volume 28, Number 13, pp 1363–1372
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Comparison of Classification-Based Physical Therapy With Therapy Based on Clinical Practice Guidelines for Patients with Acute Low Back Pain

A Randomized Clinical Trial

Key Points

- Patients with acute, work-related low back pain treated using a classification-based approach to physical therapy instead of an approach based on the recommendations of clinical practice guidelines showed greater improvement in disability 4 weeks after initiation of treatment.
- Patients treated using a classification-based approach instead of an approach based on clinical practice guidelines were more likely to return to unrestricted work within the first 4 weeks after treatment.
- Patients treated using a classification-based approach instead of an approach based on clinical practice guidelines were more satisfied with their treatment after 4 weeks.
- Treatment using a classification-based approach did not result in increased medical costs, and instead showed a trend toward decreased costs, as compared with an approach based on clinical practice guidelines.

Conclusions

Better short-term outcomes were found for patients with acute, work-related LBP when they were treated using a classification-based approach to physical therapy instead of an approach based on the recommendations of clinical practice guidelines without regard for an individual patient's signs and symptoms. Although the current study examined only one patient population and clinical environment, the authors believe that identifying relevant classifications of patients with LBP will improve clinical outcomes, and will enhance the power of future clinical trials. Further research is needed to define optimum criteria for classifying and treating patients with acute LBP.

- **Median total medical costs for 1 year after injury were $1003.68 for the guideline-based group and $774.00 for the classification-based group**

SPINE Volume 31, Number 6, pp 623–631
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Identifying Subgroups of Patients With Acute/Subacute "Nonspecific" Low Back Pain

Results of a Randomized Clinical Trial

Gerard P. Brennan, PhD, PT,* Julie M. Fritz, PhD, PT, ATC,* Stephen J. Hunter, MS, PT, OCS,* Anne Thackeray, PT,* Anthony Delitto, PhD, PT, FAPTA,† and Richard E. Erhard, DC, PT†

- Better clinical outcomes (ODI) found when patients received matched treatment based on their classification
  - Short term (4 weeks)
  - Long term (1 year)

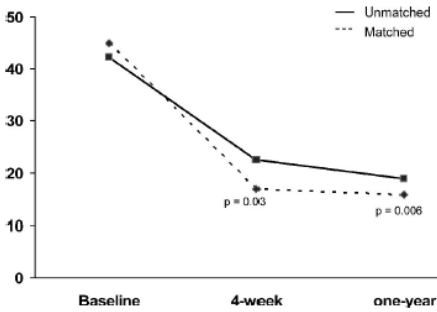

Figure 3. Oswestry scores for patients receiving matched or unmatched treatments (intention-to-treat analysis, *P* values represent differences between the baseline and follow-up scores).

SPINE Volume 31, Number 6, pp 623–631

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Key Points

- Identification of a pathoanatomical cause is elusive for many patients with low back pain, invoking a diagnostic label of "nonspecific" low back pain.
- Subgrouping patients with "nonspecific" low back pain based on signs and symptoms has been recommended by researchers and clinicians and supported by recent evidence as a means to improve outcomes.
- This study placed patients with acute/subacute low back pain into one of three treatment subgroups based on their initial signs and symptoms (manipulation, stabilization or specific exercise), then randomized patients to receive one of the three treatments.
- The short- and long-term outcomes did not differ based on the randomized treatment group, or the subgroup, but depended on the interaction between treatment group and subgroup, such that patients receiving the treatment matched to their subgroup had better outcomes than patients randomized to an unmatched treatment.
- Developing methods to subgroup patients with "nonspecific" low back pain can improve the outcomes of care.

Conclusion

The results of this study build on prior findings suggesting that "nonspecific LBP" is actually a heterogeneous condition. Meaningful subgroups of patients can be identified based on signs and symptoms from the clinical examination. Better clinical outcomes can be achieved when subgrouping is used to guide treatment decisions.

Spine

SPINE Volume 37, Number 16, pp 1347–1356

RANDOMIZED TRIAL

A Randomized Controlled Trial on the Effectiveness of a Classification-Based System for Subacute and Chronic Low Back Pain

Adri T. Apeldoorn, PhD,*† Raymond W. Ostelo, PhD,*‡ Hans van Helvoirt, MA,§ Julie M. Fritz, PhD,‖ Dirk L. Knol, PhD,* Maurits W. van Tulder, PhD,*‡ and Henrica CW de Vet, PhD*

- No sig differences in any outcomes at 8, 26, and 52 weeks between classification group and "usual PT treatment" group
- Previous studies have shown modest sig improvements when pts are classified
  - Acute and subacute non specific LBP

CLINICAL GUIDELINES

ANTHONY DELITTO, PT, PhD • STEVEN Z. GEORGE, PT, PhD • LINDA VAN DILLEN, PT, PhD • JULIE M. WHITMAN, PT, DSc
GWENDOLYN SOWA, MD, PhD • PAUL SHEKELLE, MD, PhD • THOMAS R. DENNINGER, DPT • JOSEPH J. GODGES, DPT, MA

Low Back Pain

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

J Orthop Sports Phys Ther. 2012;42(4):A1-A57. doi:10.2519/jospt.2012.0301

A INTERVENTIONS – MANUAL THERAPY

Clinicians should consider utilizing thrust manipulative procedures to reduce pain and disability in patients with mobility deficits and acute low back and back-related buttock or thigh pain. Thrust manipulative and nonthrust mobilization procedures can also be used to improve spine and hip mobility and reduce pain and disability in patients with subacute and chronic low back and back-related lower extremity pain.

C INTERVENTIONS – LOWER-QUARTER NERVE MOBILIZATION PROCEDURES

Clinicians should consider utilizing lower-quarter nerve mobilization procedures to reduce pain and disability in patients with subacute and chronic low back pain and radiating pain.

D INTERVENTIONS – TRACTION

There is conflicting evidence for the efficacy of intermittent lumbar traction for patients with low back pain. There is preliminary evidence that a subgroup of patients with signs of nerve root compression along with peripheralization of symptoms or a positive crossed straight leg raise will benefit from intermittent lumbar traction in the prone position. There is moderate evidence that clinicians should not utilize intermittent or static lumbar traction for reducing symptoms in patients with acute or subacute, nonradicular low back pain or in patients with chronic low back pain.

A INTERVENTIONS – CENTRALIZATION AND DIRECTIONAL PREFERENCE EXERCISES AND PROCEDURES

Clinicians should consider utilizing repeated movements, exercises, or procedures to promote centralization to reduce symptoms in patients with acute low back pain with related (referred) lower extremity pain. Clinicians should consider using repeated exercises in a specific direction determined by treatment response to improve mobility and reduce symptoms in patients with acute, subacute, or chronic low back pain with mobility deficits.

GRADES OF RECOMMENDATION		STRENGTH OF EVIDENCE
A	Strong evidence	A preponderance of level I and/or level II studies support the recommendation. This must include at least 1 level I study
B	Moderate evidence	A single high-quality randomized controlled trial or a preponderance of level II studies support the recommendation
C	Weak evidence	A single level II study or a preponderance of level III and IV studies including statements of consensus by content experts support the recommendation
D	Conflicting evidence	Higher-quality studies conducted on this topic disagree with respect to their conclusions. The recommendation is based on these conflicting studies
E	Theoretical/ foundational evidence	A preponderance of evidence from animal or cadaver studies, from conceptual models/principles, or from basic sciences/bench research support this conclusion
F	Expert opinion	Best practice based on the clinical experience of the guidelines development team

Effectiveness of an Extension-Oriented Treatment Approach in a Subgroup of Subjects With Low Back Pain: A Randomized Clinical Trial

Physical Therapy Volume 87 Number 12 December 2007

- 48 subjects with LBP radiating into the buttock and thigh whose pain was found to centralize with repeated extension movements
- 2 groups
  - Extension oriented treatment approach (EOTA)
    - Repeated extension exercises
    - PA mobilizations
  - Stabilization group as described by Hicks et al
- EOTA showed sig improvements in disability measures at 1 week, 4 week ad 6 month follow-ups

Efficacy of Directional Preference Management for Low Back Pain: A Systematic Review

Luke D. Surkitt, Jon J. Ford, Andrew J. Hahne, Tania Pizzari, Joan M. McMeeken

Volume 92 Number 5 Physical Therapy May 2012

- Some evidence through RCT to support directional preference management
  - Short term and intermediate effects
  - However no significant evidence and some studies show no effect

The Immediate Reduction in Low Back Pain Intensity Following Lumbar Joint Mobilization and Prone Press-ups Is Associated With Increased Diffusion of Water in the L5-S1 Intervertebral Disc

| MAY 2010 | VOLUME 40 | NUMBER 5 | JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY

- Pt's with LBP who were classified into an extension based treatment group
- Looked at diffusion of water from the L5/S1 disc after press ups and PA mobs
- Relationship found between significant reduction of pain and significant increase in diffusion of water from the disc

The effect of increasing sets (within one treatment session) and different set durations (between treatment sessions) of lumbar spine posteroanterior mobilisations on pressure pain thresholds

Manual Therapy xxx (2012)

- Assessment of PPT at L4 before, during and after PA mobilizations
  - 19 asymptomatic subjects
- Compared up to 5 sets of either 30 or 60 seconds of mobilizations
- 4+ sets of mobilization achieved the greatest change in PPT
  - No sig difference between 30-60 sec

The Immediate Effect of Posteroanterior Mobilization on Reducing Back Pain and the Stiffness of the Lumbar Spine

Archives of Physical Medicine and Rehabilitation 2013;94:673-9

- Looked at the effects of grade 3 PA mobilizations to L4 on pain and mobility
  - Symptomatics and asymptomatics
  - No control
- Significant improvements in reported pain found in symptomatic group following 3 cycles of 60 second mobilizations
- Significant improvements in ROM flexion and extension for both groups after mobilizations

Lumbar Treatment PA mobilization

Central PA

Unilateral PA in extension

Lumbar Treatment – Lumbar Extension in SB

ELSEVIER
Available online at www.sciencedirect.com
ScienceDirect
Manual Therapy 11 (2006) 279–286
MANUAL THERAPY
www.elsevier.com/locate/math

Original article

Slump stretching in the management of non-radicular low back pain: A pilot clinical trial☆

- Control Group
  - Lumbar mobilization and exercise
- Experimental Group
  - Slump stretching, + control group treatment
- Sig improvement in all outcome measures for experimental group

Slump Stretching

- Slump Stretch
  - Therapist OP cervical flexion in position shown
    - Holds 5 x 30 seconds
  - HEP in position shown
    - Holds 2 x 30 seconds

Effect of slump stretching versus lumbar mobilization with exercise in subjects with non-radicular low back pain: a randomized clinical trial

Journal of Manual and Manipulative Therapy 2012 VOL. 20 NO. 1

- 60 pt with non radicular LBP and no neurological signs
  - Pt had pain > 3 months
- Control Group
  - Lumbar mobilization and ther-ex
- Experimental group
  - Control Rx plus slump stretching
- Sig improvement for all outcome measures for experimental group

Slump Stretching

Journal of Manual and Manipulative Therapy 2012 VOL. 20 NO. 1

5 reps of 30 second holds
2x week x 3 weeks

2 reps of 30 second holds
Daily

- **Associated Factors for expected outcome**

Favorable	Unfavorable
Centralizes with movement, age, first episode, recent onset	Radiating symptoms, no help at home

- If referral to other providers is indicated, Identify: Specific Recommendations.

Pain management for possible steroid injection or spine surgeon for consultation

SPINE Volume 29, Number 21, pp 2350–2356
©2004, Lippincott Williams & Wilkins, Inc.

Early Intervention for the Management of Acute Low Back Pain

A Single-Blind Randomized Controlled Trial of Biopsychosocial Education, Manual Therapy, and Exercise

- Control group (assess/advise/wait)
  - Entry into PT after 6 weeks of symptom onset
- Experimental group (assess/advise/treat)
  - Entry into PT within 6 weeks of symptom onset
- 6 month follow-up
  - Experimental group demonstrated significantly better outcomes in
  - Disability, Mental Health, Anxiety, General Health, Vitality, ***Depression***, Social Function
  - Control group was 31% more likely to develop depression compared to experimental group

Primary Care Referral of Patients With Low Back Pain to Physical Therapy

Impact on Future Health Care Utilization and Costs

Julie M. Fritz, PT, PhD, ATC,* John D. Childs, PT, PhD,† Robert S. Wainner, PT, PhD,‡ and Timothy W. Flynn, PT, PhD§

SPINE Volume 37, Number 25, pp 2114–2121
©2012, Lippincott Williams & Wilkins

- 76,967 pt with diagnosis of LBP presenting to primary care identified over 18 month
- PT utilization associated with higher healthcare costs over 18 month period
  - Early PT associated with significantly less healthcare use compared to delayed PT
    - Decreased advanced imaging, additional physician visits, surgery, injections and opioid use

Review article

Centralization and directional preference: A systematic review

Stephen May [a,*], Alessandro Aina [b]

Manual Therapy xxx (2012) 1–10

- Centralization is a common clinical finding that can be reliably identified
- Phenomenon has important therapeutic and prognostic value
  - Centralization associated with good prognosis in 21/23 studies examined
  - Significantly less likely to have surgery
- Non-centralization associated with poorer prognosis

Which Prognostic Factors for Low Back Pain Are Generic Predictors of Outcome Across a Range of Recovery Domains?

Chad E. Cook, Kenneth E. Learman, Bryan J. O'Halloran, Christopher R. Showalter, Vincent J. Kabbaz, Adam P. Goode, Alexis A. Wright

Volume 93 Number 1 Physical Therapy January 2013

- 10 prognostic variables were selected
- Meeting the CPR for lumbar manipulation was greatest predictor of positive outcome regardless of treatment choice
  - Initial symptom irritability and age were next variables

SPINE Volume 30, Number 16, pp 1881–1886
©2005, Lippincott Williams & Wilkins, Inc.

Prognostic Factors for Low Back Pain in Patients Referred for Physiotherapy

Comparing Outcomes and Varying Modeling Techniques

- Most gains made occur within first 3 months after intervention
  - Modest gains beyond that
- Most consistent prognostic variable was duration of symptoms prior to intervention
  - Paying job
  - Intensity of symptoms
  - Functional disability index

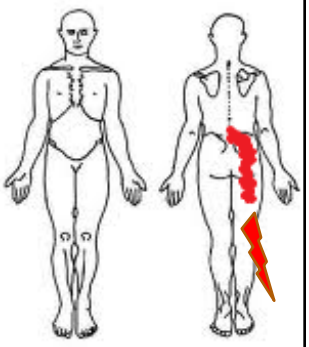
Pattern Recognition

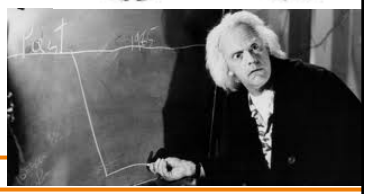
Identify the key subjective and physical features (i.e. **clinical pattern**) that would help you recognize this disorder in the future.

Subjective	Physical
MOI: lifting injury Back pain with referred pain into the buttock and thigh Pain exacerbated with lifting and flexion postures Pain alleviated with extension postures	Flexion motion of the lumbar spine increases lumbar spine pain and referred pain Lateral shift posture Repeated extension centralizes pain + neurodynamic testing reproducing their peripheral symptoms

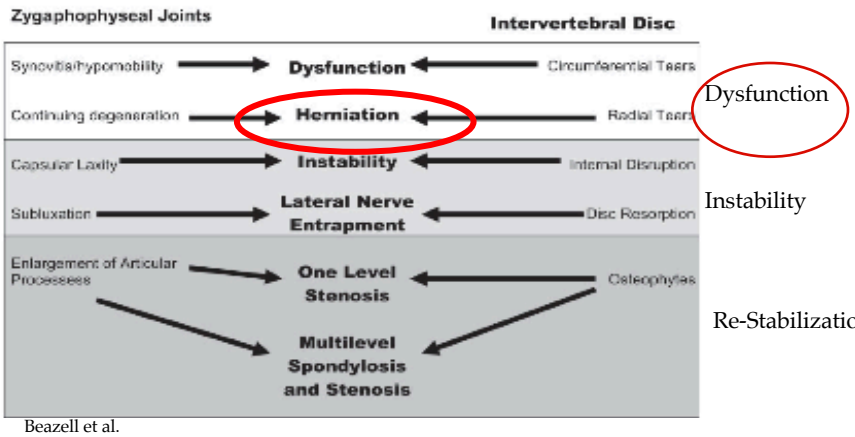
Alternate Ending – Case 1b

- Same patient, 5 yrs later
- Another episode of symptoms after catching her 7 y/o jumping off the couch, describing flexion/rotation mechanism
- Describes similar LBP as previous episode but now with sharp, shooting, burning, radiating symptoms along posterior-lateral hamstring, lateral calf and dorsal foot with occasional numbness/tingling into toes
- Symptoms described as severe with more constancy and chemical irritability





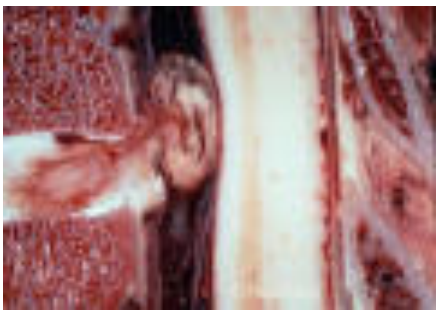
Phases of Degeneration



Beazell et al.

Lumbar Disc – Clinical Characteristics

- Extruded/Sequestered
  - Moderate to severe back and leg pain
    - Leg pain often worse than back pain
  - Lateral deviation with decreased weight bearing through symptomatic LE
  - Limited trunk movement
  - Radicular pain and radiculopathy likely



Radicular Pain

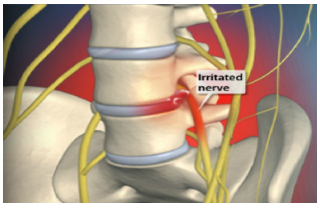
- Pain as a result or irritation of a nerve root or spinal nerve
  - Can occur without radiculopathy
- Quality of radicular pain is "lancinating"
  - Thin band traveling down an extremity
- Disc herniation is the #1 cause of radicular pain
  - Nuclear material starts an inflammatory response
    - Chemicals of inflammation irritate nerve root
    - Edema can lead to compression causing radiculopathy
    - Inflammation also irritates dura leading to somatic referred pain

Radiculopathy

- Neurological condition where nerve conduction is compromised
  - Due to compression or ischemia
  - Leads to weakness and/or sensation loss not pain
    - Pain is due to noxious stimuli to somatic structure (referred) or nerves (radicular)
      - Compression and ischemia is not noxious

Lumbar Radiculopathy

- Epidemiology
  - Prevalence of lumbosacral radiculopathy is approx. 3% - 5%
  - Distributed equally in men and women
  - Men most likely to develop symptoms in 40s
  - Women most likely to develop symptoms between 50-60



Degenerative
- Intervertebral disk herniation
- Degenerative lumbar spondylosis

Neoplastic
- Primary tumors
  - Ependymoma
  - Schwannoma
  - Neurofibroma
  - Lymphoma
  - Lipoma
  - Dermoid
  - Epidermoid
  - Hemangioblastoma
  - Paraganglioma
  - Ganglioneuroma
  - Osteoma
  - Plasmacytoma
- Metastatic tumors
- Leptomeningeal metastasis

Infectious
- Herpes zoster (HZ)
- Spinal epidural abscess (SEA)
- HIV/AIDS-related polyradiculopathy
- Lyme disease

Inflammatory/metabolic
- Diabetic amyotrophy
- Ankylosing spondylitis
- Paget's disease
- Arachnoiditis
- Sarcoidosis

Developmental
- Tethered cord syndrome
- Dural ectasia

Other
- Lumbar spinal cysts
- Hemorrhage

Lumbar Radiculopathy Presentations

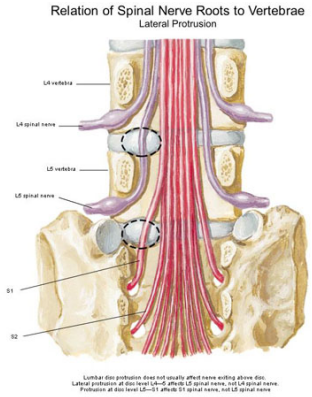
Neurologic examination findings in monoradiculopathies

Root level	Pain	Sensory loss (paresthesias)	Motor abnormalities or weakness	Muscle stretch reflex abnormalities
L1	Inguinal region	Inguinal region	None	None
L2	Groin, anterior thigh	Anterolateral thigh	Iliopsoas	None
L3	Anterior thigh to knee, anterior leg	Medial thigh and knee	Quadriceps, iliopsoas, hip adductors	Knee jerk
L4	Medial foreleg	Medial lower leg	Tibialis anterior, quadriceps, hip adductors	Knee jerk
L5	Lateral thigh and lower leg, dorsum foot	Lateral lower leg, dorsum foot, great toe	Toe extensors and flexors, ankle dorsiflexor, everter and inverter, hip abductors	Internal hamstrings
S1	Posterior thigh, calf, heel	Sole, lateral foot and ankle, lateral two toes	Gastrocnemius, hamstrings, gluteus maximus, toe flexors	Ankle jerk
S2-4	Medial buttocks	Medial buttocks, perineal, perianal region	None unless S1-2 involved	Bulbocavernosus, anal wink. Ankle jerk if S1 involved

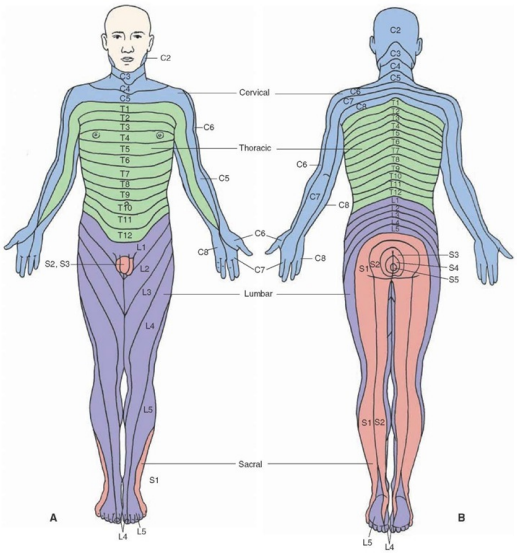
Lumbar Disc Pathology

Herniation

- Vertical orientation of the L/S roots
- Typical posterolateral disc herniation may effect the nerve root exiting the IVF below
  - L4-5 disc effects L5 nerve root
- Posteromedial disc herniation may effect the nerve root exiting 2 IVF below
  - L4-5 disc effects the S1 nerve root



Lumbar Radiculopathy
Lower Extremity Dermatomes

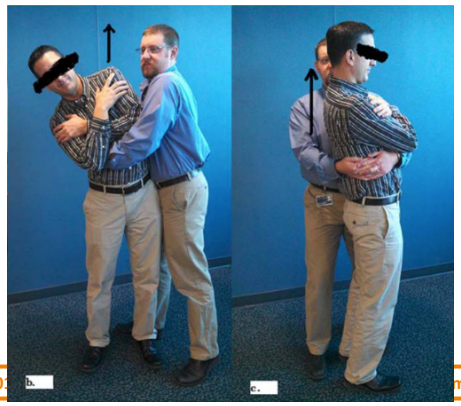


Lumbar Mobilization with Neurodynamic Positioning (Elvey)

Manual unloading of the lumbar spine: can it identify immediate responders to mechanical traction in a low back pain population? A study of reliability and criterion referenced predictive validity

Journal of Manual and Manipulative Therapy 2014

- Test shows good predictive validity for those who would benefit from mechanical traction



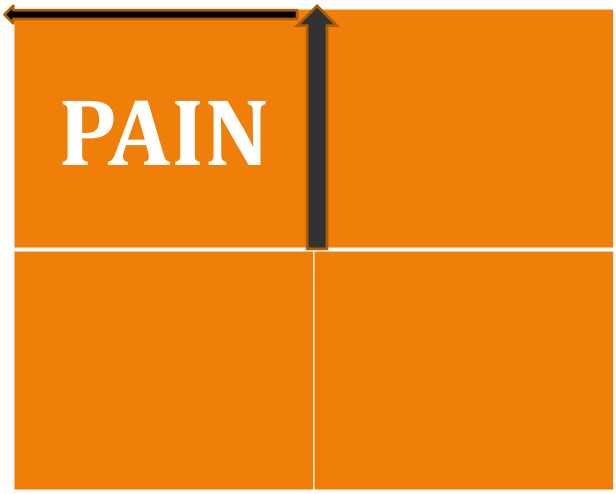
Manual Traction/Unweighting Options

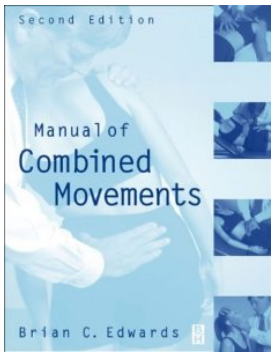
The Effectiveness of Mechanical Traction Among Subgroups of Patients With Low Back Pain and Leg Pain: A Randomized Trial

| MARCH 2016 | VOLUME 46 | NUMBER 3 | JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY

No difference found between EOTA and an EOTA with mechanical traction for treatment of lumbar radiculopathy

Combined Movement Treatment





Lumbar Treatment – SB PPIVM Progression

Lumbar Treatment PA mobilization

Central PA

Unilateral PA in extension