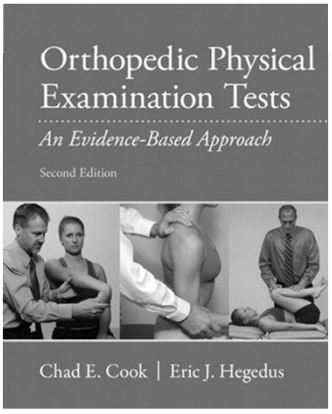
NEUROMECHANICAL INNOVATIONS

EXPERIENCE THE NEXT GENERATION OF CHIROPRACTIC®



Introduction to Diagnostic Accuracy

Physical Examination:

1) Initial patient screening
2) Diagnostic test
3) Outcome measure

*Must be reliable and valid

NEUROMECHANICAL INNOVATIONS

EXPERIENCE THE NEXT GENERATION OF CHIROPRACTIC®

The Pelvis Region

Clinical Considerations of Manual Examination

ImpulseAdjusting TECHNIQUE®

next mechanical INNOVATIONS

Physical Examination

To demonstrate a subluxation based on the physical examination, two of the following four PART criteria are required, one of which must be either Asymmetry/misalignment or Range-of-motion abnormality:

- Pain/tenderness (P)
- Asymmetry/misalignment (A)
- Range-of-motion abnormality (R)
- Tissue, tone changes (T)

ImpulseAdjusting TECHNIQUE®

3

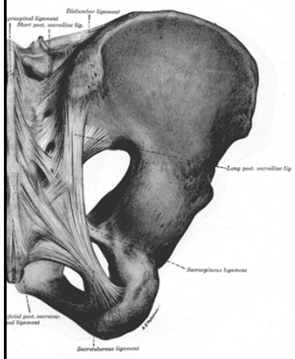
ImpulseAdjusting SYSTEM®

4

Symptoms of a Sacroiliac Subluxation/Fixation:

ImpulseAdjusting TECHNIQUE

Torque mechanical INNOVATIONS



- Low back pain/stiffness
- Hip pain/stiffness
- Groin pain
- Knee, leg, ankle pain/stiffness
- "Catch" in the hip
- Knee wants to "give out"
- Ankle "turns easy"
- Mimic disc herniation with radicular symptoms

Schamberger, *The Malalignment Syndrome: Implications for Medicine & Sport,* 2002, Elsevier
Bernard & Kirkaldy-Willis, *Clinical Orthopaedics and Related Research,* 1987: 217(266-280

ImpulseAdjusting TECHNIQUE

5

Oswestry Disability Questionnaire:
0-20 = mild
21-40 = moderate
41 & up = severe

Back Index
ChiroCare Form BI-100

Patient Name _____ *Date* _____

This questionnaire will give your provider information about how your back condition affects your everyday life. Please answer every section by marking the one statement that applies to you. If two or more statements in one section apply, please mark the one statement that most closely describes your problem.

Pain Intensity
⓪ The pain comes and goes and is very mild.
① The pain is mild and does not vary much.
② The pain comes and goes and is moderate.
③ The pain is moderate and does not vary much.
④ The pain comes and goes and is very severe.
⑤ The pain is very severe and does not vary much.

Sleeping
⓪ I get no pain in bed.
① I get pain in bed but it does not prevent me from sleeping well.
② Because of pain my normal sleep is reduced by less than 25%.
③ Because of pain my normal sleep is reduced by less than 50%.
④ Because of pain my normal sleep is reduced by less than 75%.
⑤ Pain prevents me from sleeping at all.

Sitting
⓪ I can sit in any chair as long as I like.
① I can only sit in my favorite chair as long as I like.
② Pain prevents me from sitting more than 1 hour.
③ Pain prevents me from sitting more than 1/2 hour.
④ Pain prevents me from sitting more than 10 minutes.
⑤ I avoid sitting because it increases pain immediately.

Standing
⓪ I can stand as long as I want without pain.
① I have some pain while standing but it does not increase with time.
② I cannot stand for longer than 1 hour without increasing pain.
③ I cannot stand for longer than 1/2 hour without increasing pain.
④ I cannot stand for longer than 10 minutes without increasing pain.
⑤ I avoid standing because it increases pain immediately.

Walking
⓪ I have no pain while walking.
① I have some pain while walking but it doesn't increase with distance.
② I cannot walk more than 1 mile without increasing pain.
③ I cannot walk more than 1/2 mile without increasing pain.
④ I cannot walk more than 1/4 mile without increasing pain.
⑤ I cannot walk at all without increasing pain.

Personal Care
⓪ I do not have to change my way of washing or dressing in order to avoid pain.
① I do not normally change my way of washing or dressing even though it causes some pain.
② Washing and dressing increases the pain but I manage not to change my way of doing it.
③ Washing and dressing increases the pain and I find it necessary to change my way of doing it.
④ Because of the pain I am unable to do some washing and dressing without help.
⑤ Because of the pain I am unable to do any washing and dressing without help.

Lifting
⓪ I can lift heavy weights without extra pain.
① I can lift heavy weights but it causes extra pain.
② Pain prevents me from lifting heavy weights off the floor.
③ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned (e.g., on a table).
④ Pain prevents me from lifting heavy weights off the floor, but I can manage light to medium weights if they are conveniently positioned.
⑤ I can only lift very light weights.

Traveling
⓪ I get no pain while traveling.
① I get some pain while traveling but none of my usual forms of travel make it worse.
② I get extra pain while traveling but it does not cause me to seek alternate forms of travel.
③ I get extra pain while traveling which causes me to seek alternate forms of travel.
④ Pain restricts all forms of travel except that done while lying down.
⑤ Pain restricts all forms of travel.

Social Life
⓪ My social life is normal and gives me no extra pain.
① My social life is normal but increases the degree of pain.
② Pain has no significant affect on my social life apart from limiting my more energetic interests (e.g., dancing, etc).
③ Pain has restricted my social life and I do not go out very often.
④ Pain has restricted my social life to my home.
⑤ I have hardly any social life because of the pain.

Changing degree of pain
⓪ My pain is rapidly getting better.
① My pain fluctuates but overall is definitely getting better.
② My pain seems to be getting better but improvement is slow.
③ My pain is neither getting better or worse.
④ My pain is gradually worsening.
⑤ My pain is rapidly worsening.

Back Index Score ____

Signature of Patient

6

Dreyfuss et al, "The Value of Medical History and Physical Examination in Diagnosing Sacroiliac Joint Pain," *Spine* 1996; 21(22):2594-602.

ImpulseAdjusting TECHNIQUE

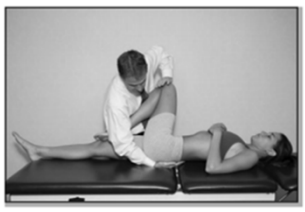
mechanical INNOVATIONS

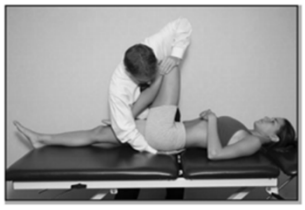
- **12 SIJ tests evaluated by a multidisciplinary expert panel to identify a SIJ test that is clinically valuable.**
- **Included: Gillet test, Thigh Thrust, Patrick's Test, Gaenslen's Test, Midline Sacral Thrust, Sacral Sulcus Tenderness, Joint Play and others.**
- **Results compared to SI block ("gold" standard):**
- **4 tests faired best in sensitivity:**
  - **Sacral sulcus tenderness**
  - **Pain over the SIJ**
  - **Buttock Pain**
  - **Patient pointing to SIJ**

7

TESTS FOR SACROILIAC PAIN ORIGIN

Thigh Thrust (also known as the Ostagaard Test, 4P Test, Sacrotuberous Stress Test, and POSH Test)





1. The patient is positioned in supine. Resting symptoms are assessed.
2. The examiner stands opposite the painful side of the patient.
3. The hip on the painful side is flexed to 90 degrees.
4. The examiner places his or her hand under the sacrum to form a stable "bridge" for the sacrum.
5. A downward pressure is applied through the femur to force a posterior translation of the innominate. The patient's symptoms are assessed to determine if they are concordant.
6. A positive test is concordant pain that is posterior to the hip or near the sacroiliac joint. A positive test requires reproduction of pain on the thrust side (the side of the loaded femur).

UTILITY SCORE 2

ImpulseAdjusting SYSTEM

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UTILITY SCORE 2

Study	Reliability	Sensitivity	Specificity	LR+	LR−	QUADAS Score (0–14)
Laslett & Williams[25]	0.82	NT	NT	NA	NA	NA
Dreyfuss et al.[13]	0.64	36	50	0.72	1.28	10
Kokmeyer et al.[23]	0.67	NT	NT	NA	NA	NA
Damen et al.[11]	NT	62	72	2.2	0.53	8
Ostagaard & Andersson[36]	NT	80	81	4.21	0.25	5
Broadhurst & Bond[6]	NT	80	100	NA	NA	9
Albert et al.[1]	0.70	84–93*	98	46.5	0.07–0.16	7
Laslett et al.[24]	NT	88	69	2.8	0.17	12
Arab et al.[2]	0.60 right 0.40 left	NT	NT	NA	NA	NA
Ozgocmen et al.[37]* (Right)	NT	55	70	1.91	0.62	10
Ozgocmen et al.[37]* (Left)	NT	45	86	3.29	0.63	10
Gutke et al.[18]	NT	88	89	8.0	0.13	7

Comments: One of the few sacroiliac tests that exhibits fair sensitivity. To accurately perform the test make sure the thigh is held in neutral adduction and at 90 degrees of flexion.

*Ozgocmen et al.[37] assessed patients with acute sacroilitis.

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7 Step IAS Pelvic Analysis

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mechanical INNOVATIONS

Consideration of PART During:

1. Postural Observation
2. Prone Hip Extension Test (Active & Passive)
3. Bilateral Knee Flexion Test
4. Unilateral Knee Flexion Test
5. Hip Rotation Tests
6. Lower Extremity Muscle Compression Tests
7. Lumbo-pelvic Muscle Compression Tests

ImpulseAdjusting SYSTEM®

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Step 1. Postural Asymmetry

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

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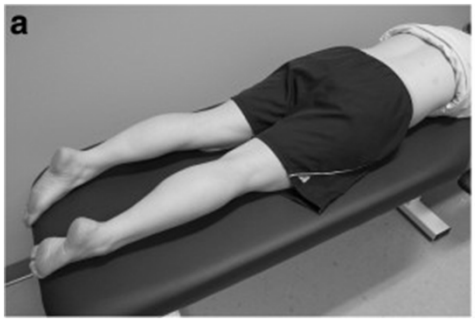
Step 2. Prone Hip Extension Test

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS



ImpulseAdjusting SYSTEM

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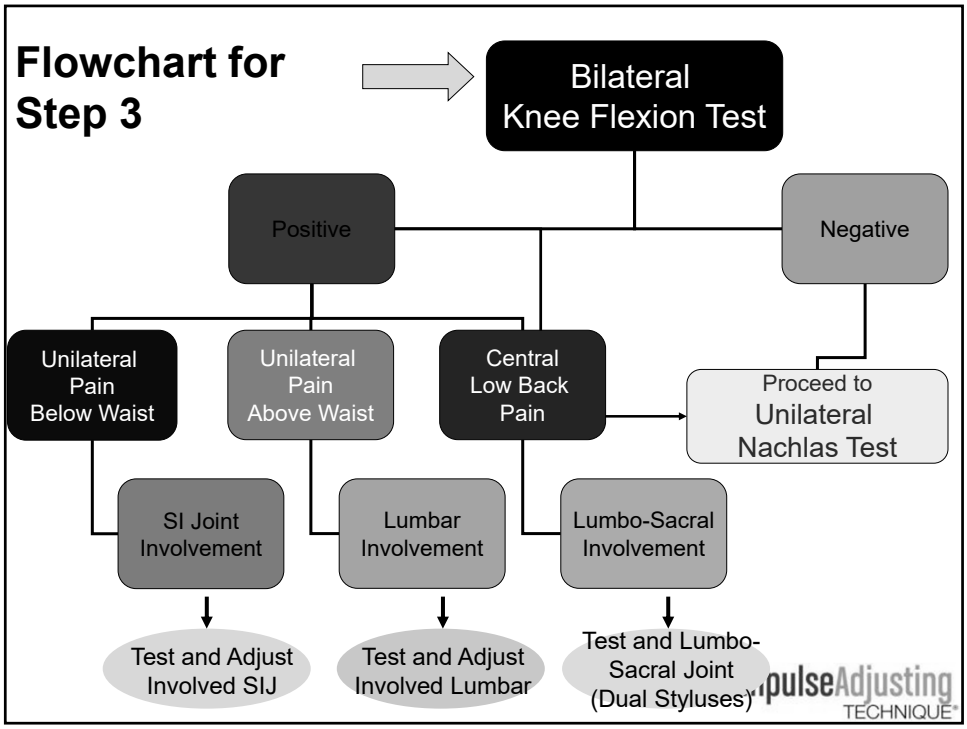
Step 3. Bilateral Knee Flexion Test

Note: this is not a knee ROM test. Both knees are flexed to the point of rectus femoris "resistance."

13

Step 3. Bilateral Knee Flexion Test

14


Flowchart for Step 3
Bilateral Knee Flexion Test
Positive
Negative
Unilateral Pain Below Waist
Unilateral Pain Above Waist
Central Low Back Pain
Proceed to Unilateral Nachlas Test
SI Joint Involvement
Lumbar Involvement
Lumbo-Sacral Involvement
Test and Adjust Involved SIJ
Test and Adjust Involved Lumbar
Test and Lumbo-Sacral Joint (Dual Styluses)
ImpulseAdjusting TECHNIQUE

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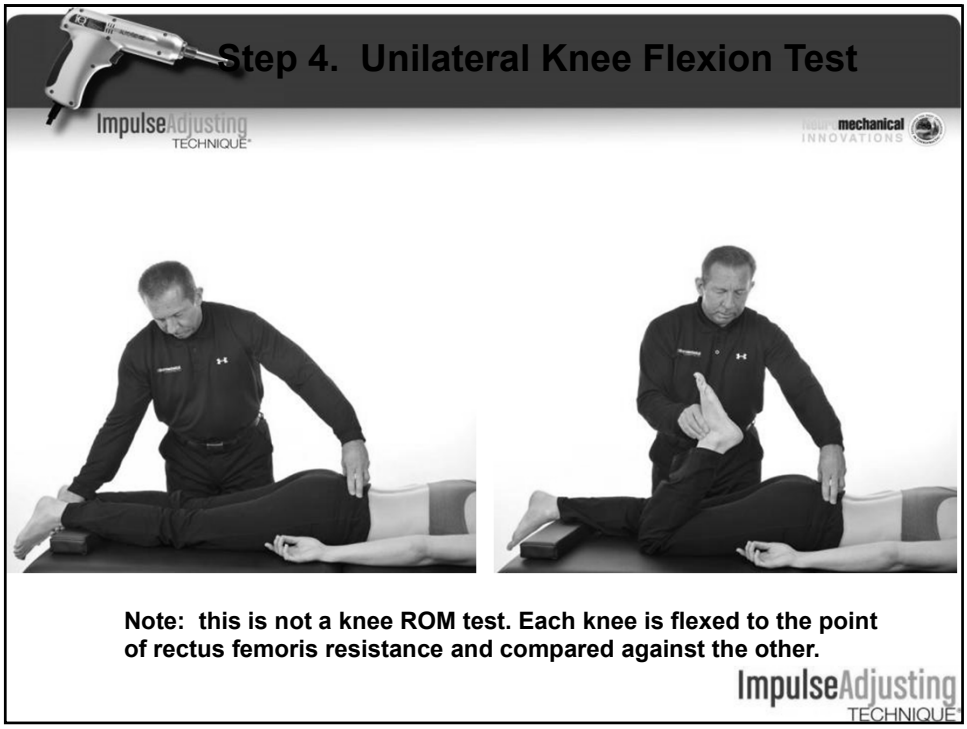
Step 4. Unilateral Knee Flexion Test
ImpulseAdjusting TECHNIQUE
mechanical INNOVATIONS
Note: this is not a knee ROM test. Each knee is flexed to the point of rectus femoris resistance and compared against the other.
ImpulseAdjusting TECHNIQUE

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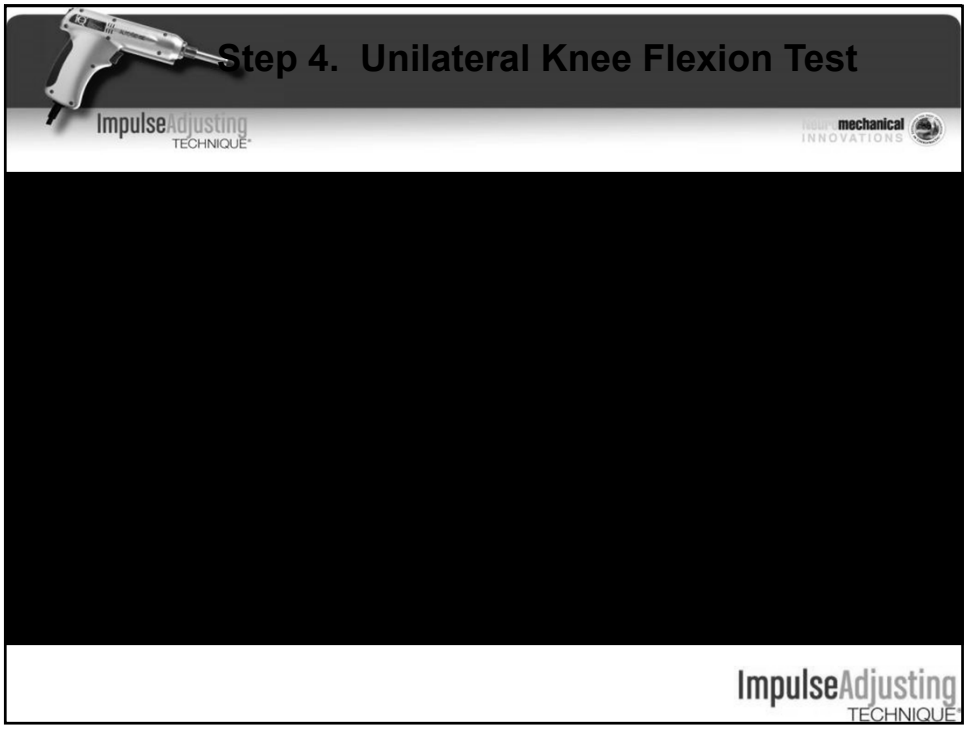
Step 4. Unilateral Knee Flexion Test
ImpulseAdjusting TECHNIQUE
mechanical INNOVATIONS
ImpulseAdjusting TECHNIQUE

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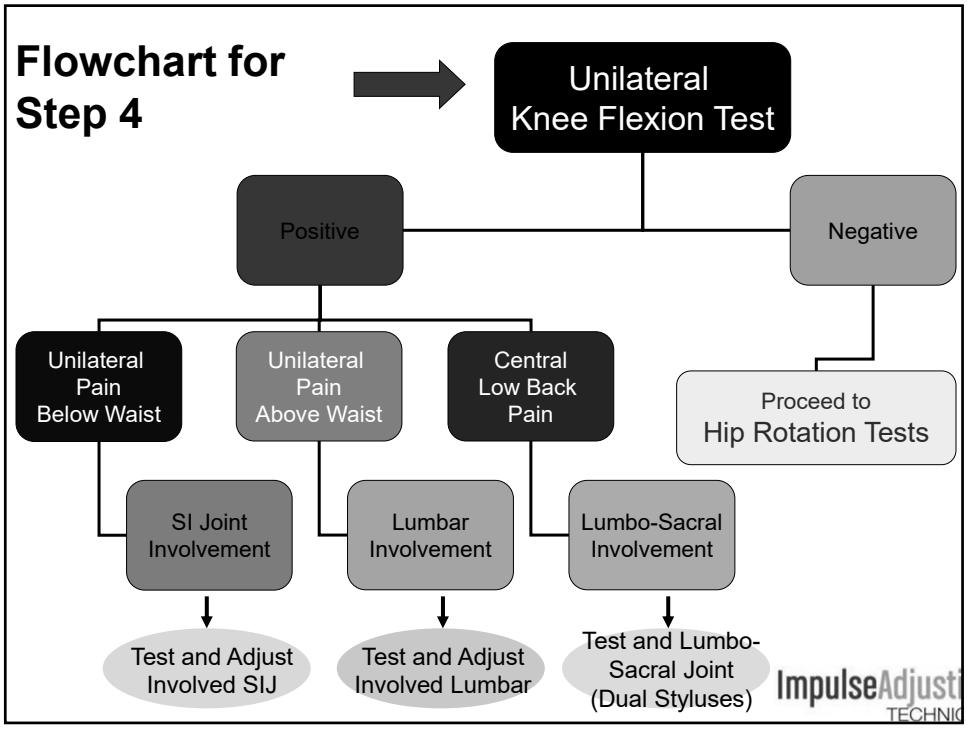
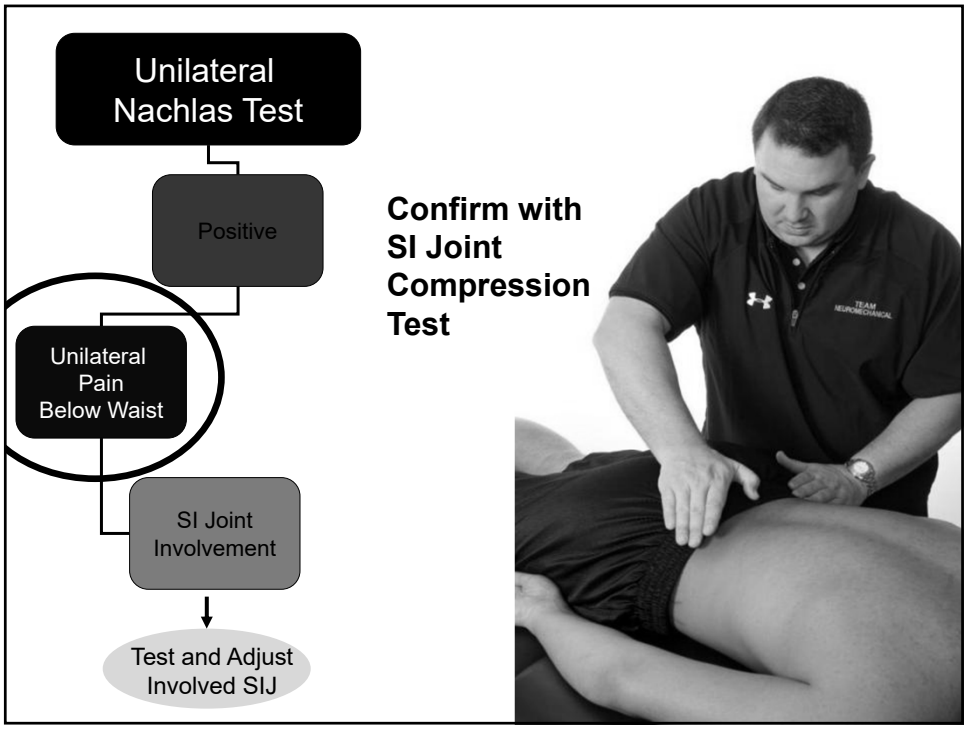
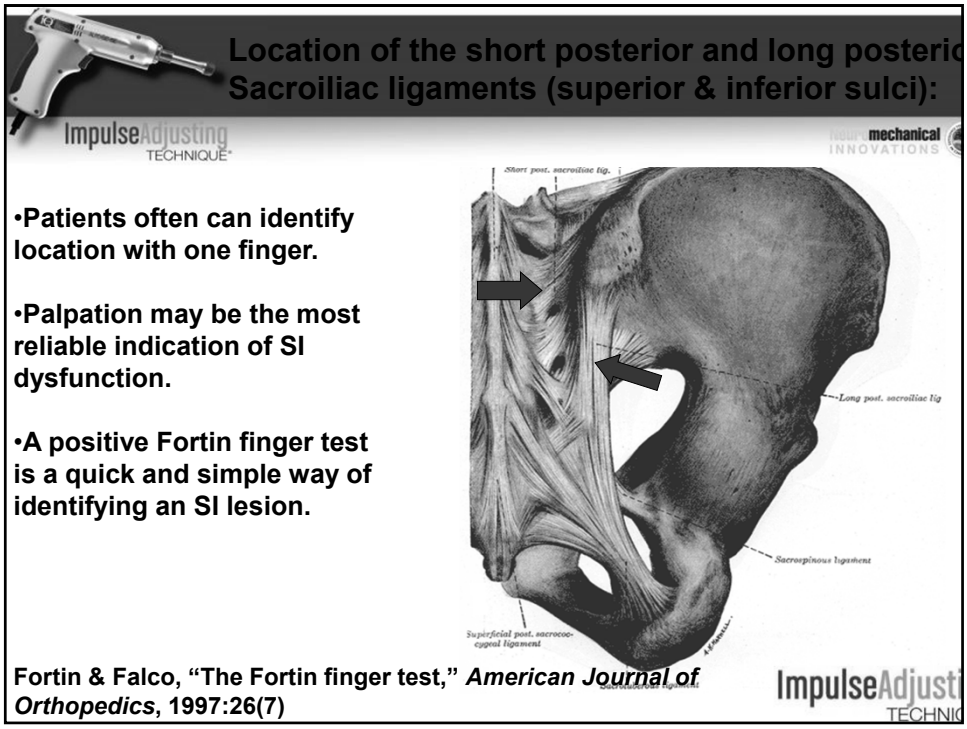

Flowchart for Step 4
Unilateral Knee Flexion Test
Positive
Negative
Unilateral Pain Below Waist
Unilateral Pain Above Waist
Central Low Back Pain
Proceed to Hip Rotation Tests
SI Joint Involvement
Lumbar Involvement
Lumbo-Sacral Involvement
Test and Adjust Involved SIJ
Test and Adjust Involved Lumbar
Test and Lumbo-Sacral Joint (Dual Styluses)

18


Unilateral Nachlas Test
Positive
Unilateral Pain Below Waist
SI Joint Involvement
Test and Adjust Involved SIJ
Confirm with SI Joint Compression Test

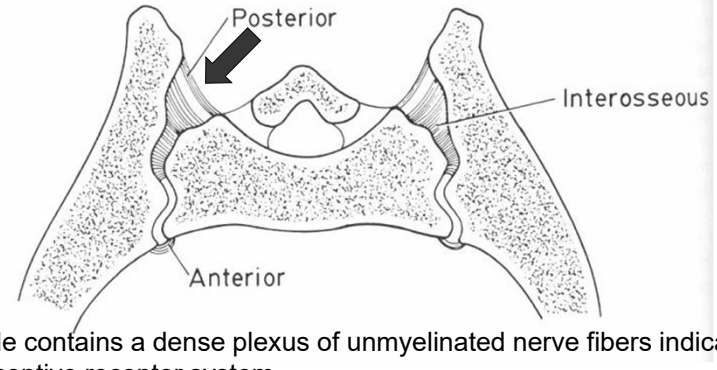
19


Location of the short posterior and long posteric
Sacroiliac ligaments (superior & inferior sulci):
ImpulseAdjusting TECHNIQUE
mechanical INNOVATIONS
•Patients often can identify location with one finger.
•Palpation may be the most reliable indication of SI dysfunction.
•A positive Fortin finger test is a quick and simple way of identifying an SI lesion.
Short post. sacroiliac lig.
Long post. sacroiliac lig
Sacrospinous ligament
Superficial post. sacrococcygeal ligament
Fortin & Falco, "The Fortin finger test," American Journal of Orthopedics, 1997:26(7)
ImpulseAdjusti
TECHNIC

20

SI joint Vectors – coronal section

Location of SI adjustment



SI capsule contains a dense plexus of unmyelinated nerve fibers indicative of a nociceptive receptor system.

Wyke, "Receptor systems in lumbosacral tissues in relation to the production of low back pain," *American Academy of Orthopaedic Surgeons Symposium on Idiopathic Low Back Pain,* Mosby, 1982

21

Impulsive Sacroiliac Adjustment

Sacroiliac Joint Adjustment

SCP: Sacroiliac joint, medial aspect of PSIS

LOD: Anterior-Superior

Setting: High (or Medium in special circ.)

22

Step 5. Hip Rotation Tests

Ilium on the side being examined must be held down firmly to prevent rotation of the pelvis.

23

Step 5. Hip Rotation Tests

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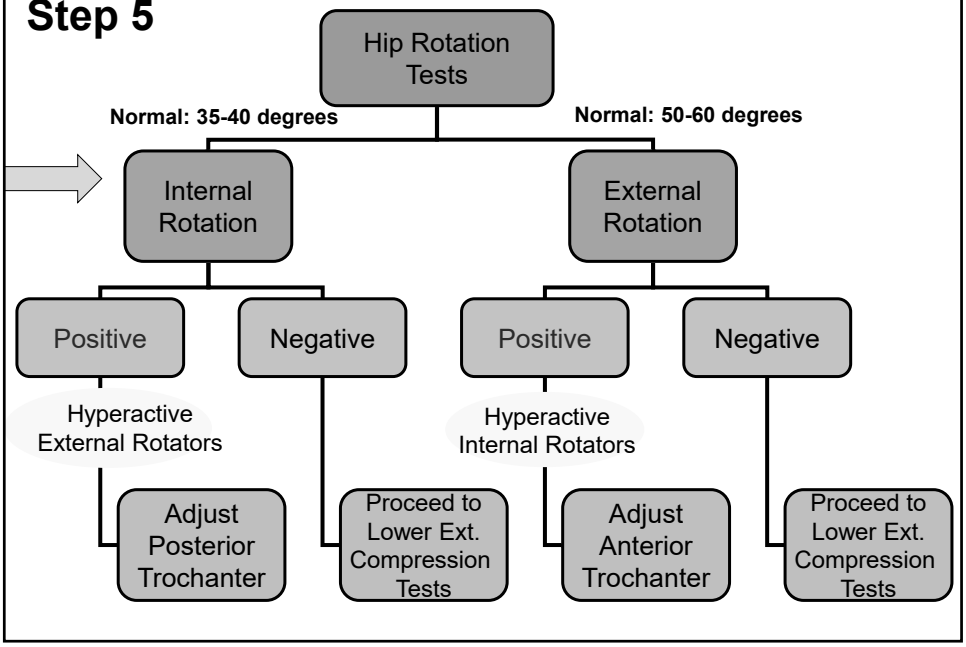
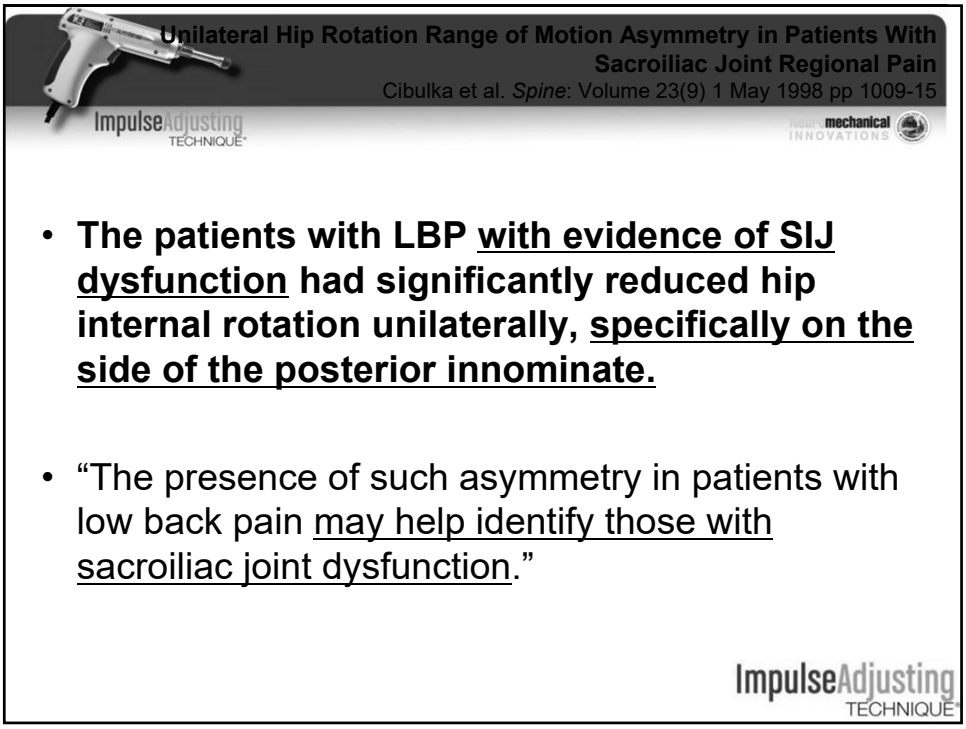
Flowchart for Step 5



25



Unilateral Hip Rotation Range of Motion Asymmetry in Patients With Sacroiliac Joint Regional Pain

Cibulka et al. *Spine*: Volume 23(9) 1 May 1998 pp 1009-15

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

- **The patients with LBP <u>with evidence of SIJ dysfunction</u> had significantly reduced hip internal rotation unilaterally, <u>specifically on the side of the posterior innominate.</u>**
- "The presence of such asymmetry in patients with low back pain <u>may help identify those with sacroiliac joint dysfunction</u>."

ImpulseAdjusting TECHNIQUE

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ImpulseAdjusting TECHNIQUE

"The Hip Joint: Myofascial and Joint Patterns,"
Marc Heller, DC, *Dynamic Chiropractic*, May 7, 2007:

new mechanical INNOVATIONS

- **Internal rotation is the first motion affected with hip capsular problems and DJD.**
- **"When you find a severe lack of internal rotation in the hip and this motion cannot be restored, the patient is usually on their way to hip replacement surgery."**

ImpulseAdjusting TECHNIQUE

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Example: Reduced internal rotation of right hip:

Step 5

Hip Rotation Tests

Internal Rotation

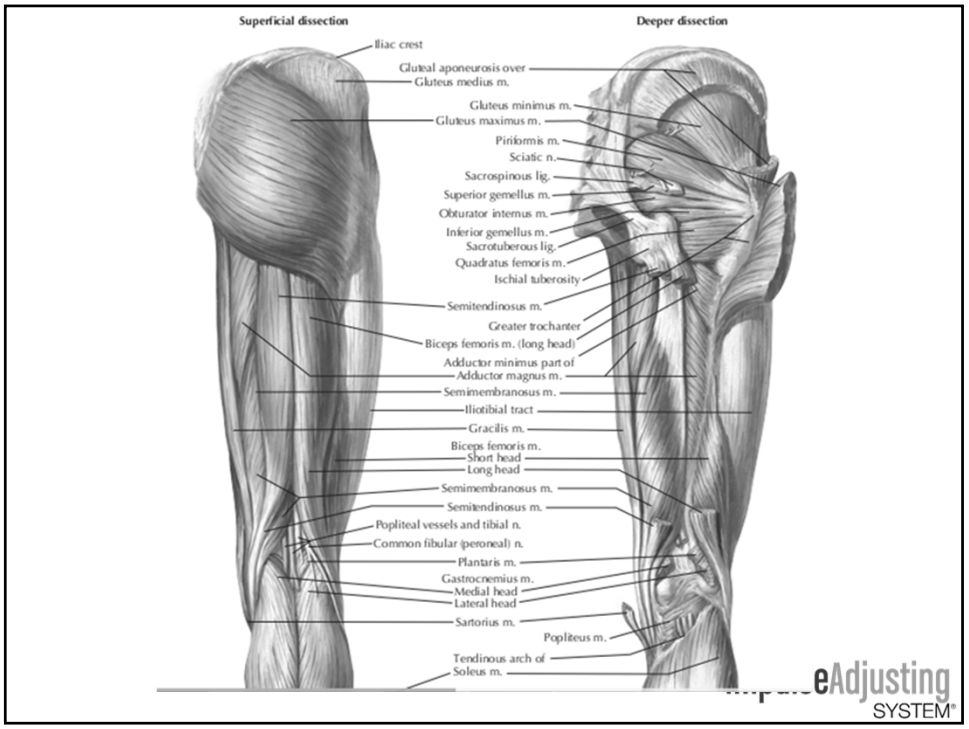
20 degrees

Positive

Hyperactive or Inhibited External Rotators

Adjust Posterior Trochanter

28


Superficial dissection
Deeper dissection
Iliac crest
Gluteal aponeurosis over
Gluteus medius m.
Gluteus minimus m.
Gluteus maximus m.
Piriformis m.
Sciatic n.
Sacrospinous lig.
Superior gemellus m.
Obturator internus m.
Inferior gemellus m.
Sacrotuberous lig.
Quadratus femoris m.
Ischial tuberosity
Semitendinosus m.
Greater trochanter
Biceps femoris m. (long head)
Adductor minimus part of
Adductor magnus m.
Semimembranosus m.
Iliotibial tract
Gracilis m.
Biceps femoris m.
Short head
Long head
Semimembranosus m.
Semitendinosus m.
Popliteal vessels and tibial n.
Common fibular (peroneal) n.
Plantaris m.
Gastrocnemius m.
Medial head
Lateral head
Sartorius m.
Popliteus m.
Tendinous arch of
Soleus m.
eAdjusting
SYSTEM®

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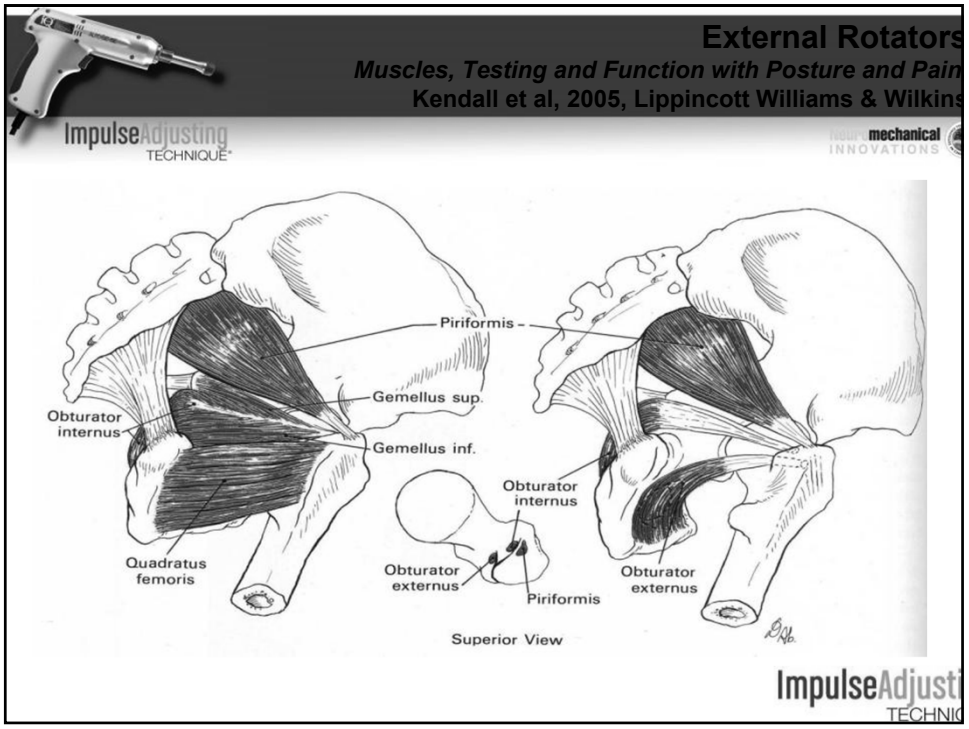
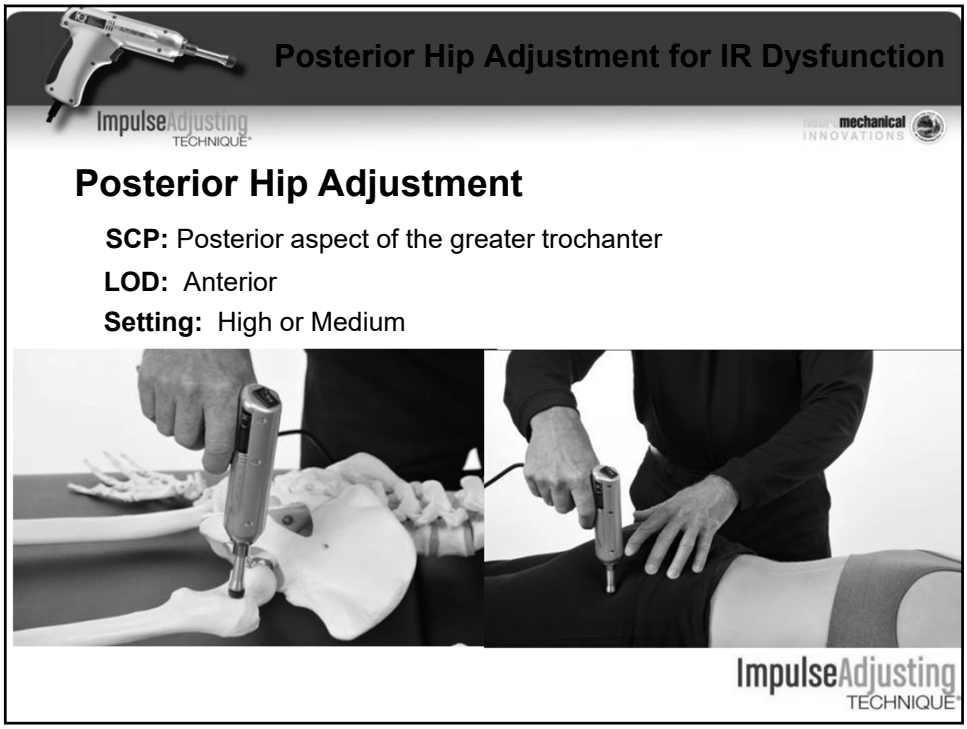

External Rotators
Muscles, Testing and Function with Posture and Pain
Kendall et al, 2005, Lippincott Williams & Wilkins
ImpulseAdjusting
TECHNIQUE
mechanical
INNOVATIONS
Piriformis
Gemellus sup.
Obturator internus
Gemellus inf.
Quadratus femoris
Obturator internus
Obturator externus
Piriformis
Obturator externus
Superior View
ImpulseAdjusti
TECHNI

30


Posterior Hip Adjustment for IR Dysfunction
ImpulseAdjusting TECHNIQUE
mechanical INNOVATIONS
Posterior Hip Adjustment
SCP: Posterior aspect of the greater trochanter
LOD: Anterior
Setting: High or Medium
ImpulseAdjusting TECHNIQUE

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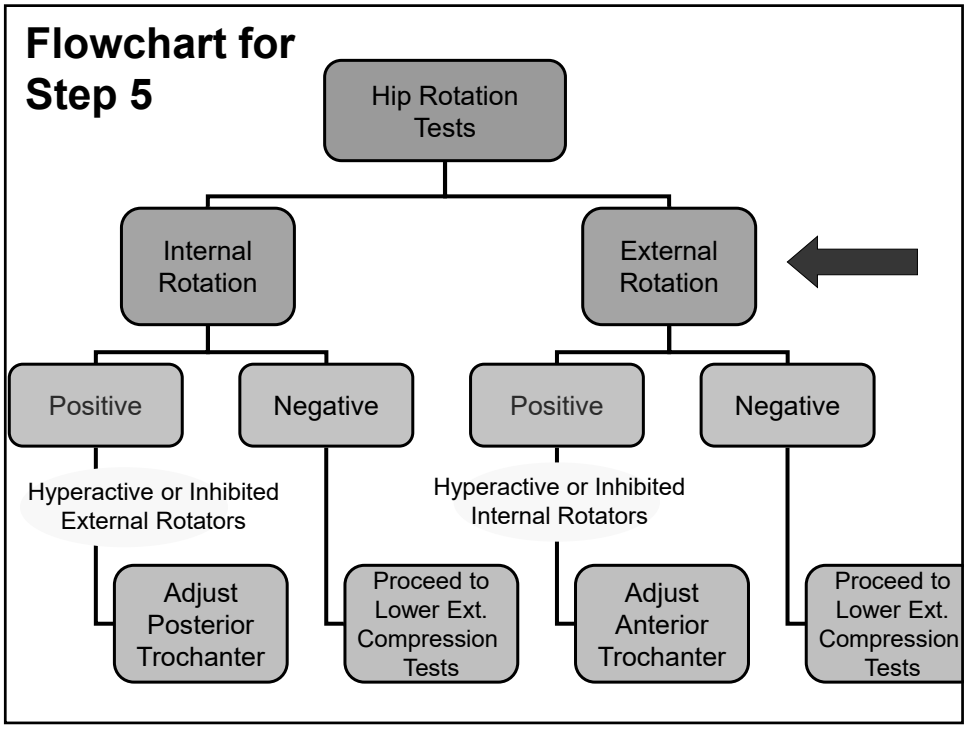
Flowchart for Step 5
Hip Rotation Tests
Internal Rotation
External Rotation
Positive
Negative
Positive
Negative
Hyperactive or Inhibited External Rotators
Hyperactive or Inhibited Internal Rotators
Adjust Posterior Trochanter
Proceed to Lower Ext. Compression Tests
Adjust Anterior Trochanter
Proceed to Lower Ext. Compression Tests

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Step 5: Hip Rotation Tests

Internal Rotation of the Left Hip

External Rotation of the Left Hip

Note asymmetries

33

Example: Reduced external rotation of right hip:

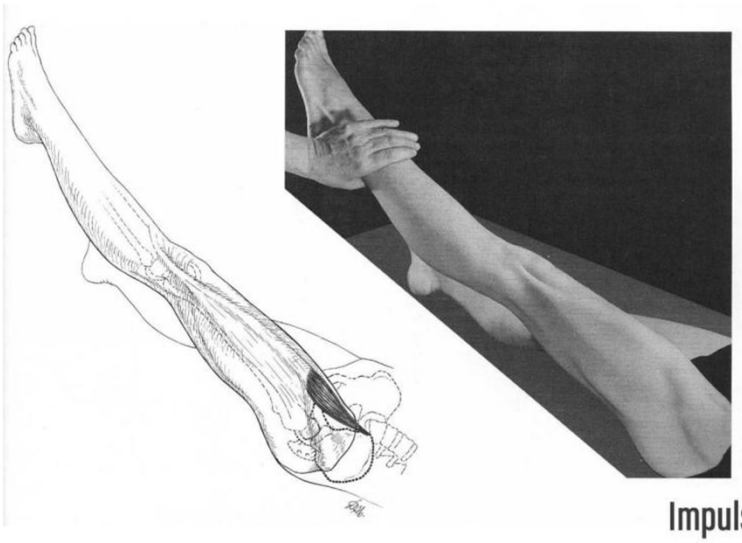
Step 5

- Hip Rotation Tests
  - 50-60 degrees
  - External Rotation
    - Positive
      - Hyperactive or Inhibited Internal Rotators
        - Adjust Anterior Trochanter

34

Hip Internal Rotators: TFL

Muscles, Testing and Function with Posture and Pain, Kendall et al, 2005, Lippincott Williams & Wilkins



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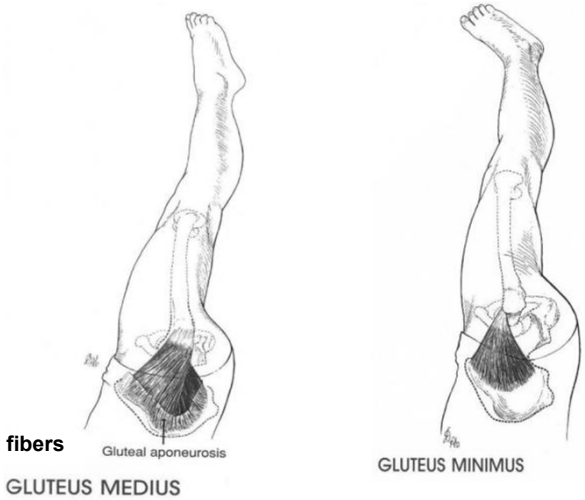
Hip Internal Rotators: TFL

Muscles, Testing and Function with Posture and Pain, Kendall et al, 2005, Lippincott Williams & Wilkins



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External Rotators

Muscles, Testing and Function with Posture and Pain, Kendall et al, 2005, Lippincott Williams & Wilkins

GLUTEUS MEDIUS

37

Anterior Hip Adjustment

(For Loss of Hip External Rotation)

Anterior Hip Adjustment

SCP: Anterior aspect of the greater trochanter

LOD: Posterior

Setting: High (or Medium in special circumstances)

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Step 6:
Lower Extremity Compression Tests

Compression Tests for Lateral Hamstring and Peroneus Longus:
Pressure applied along the muscle in a superior to inferior sweeping motion searching fo active trigger points, identified by the "jump sign."

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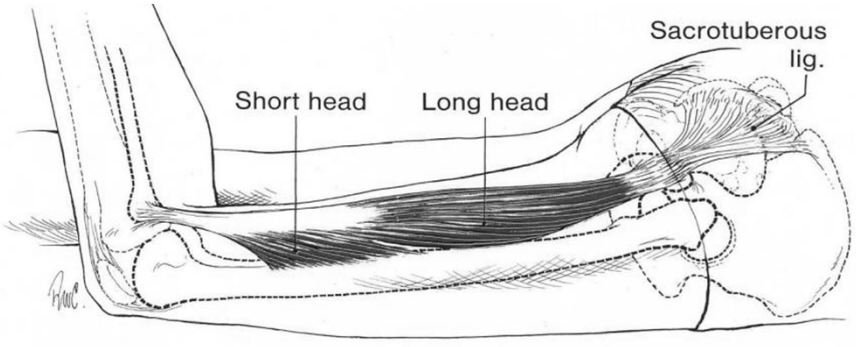
Lateral Hamstring (Biceps Femoris m.)

Muscles, Testing and Function with Posture and Pain, Kendall et al, 2005, Lippincott Williams & Wilkins



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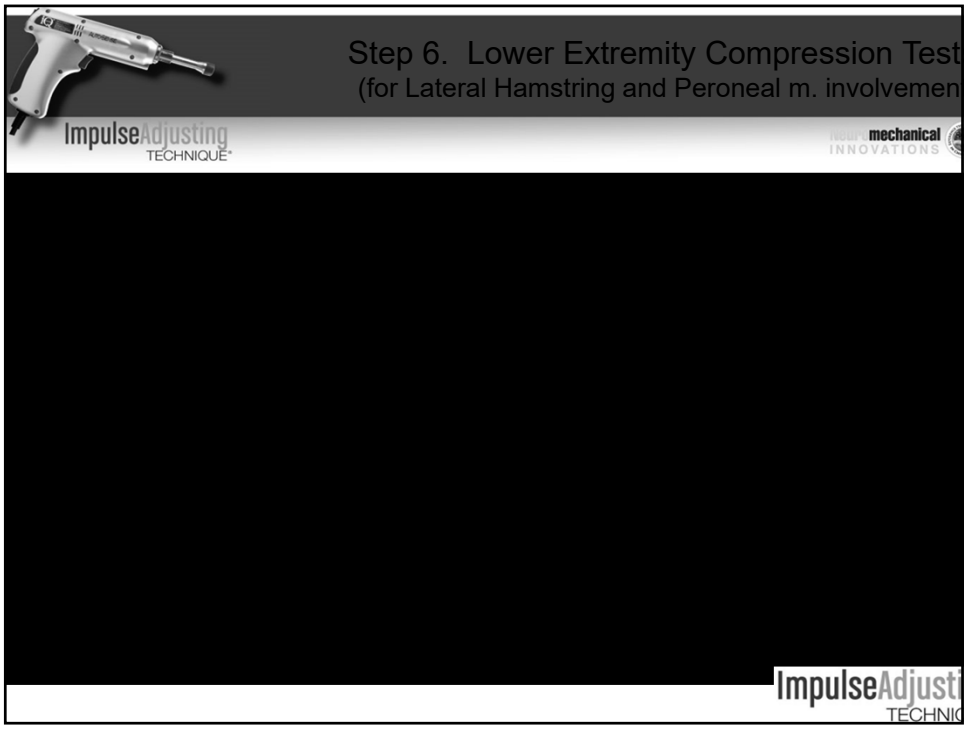
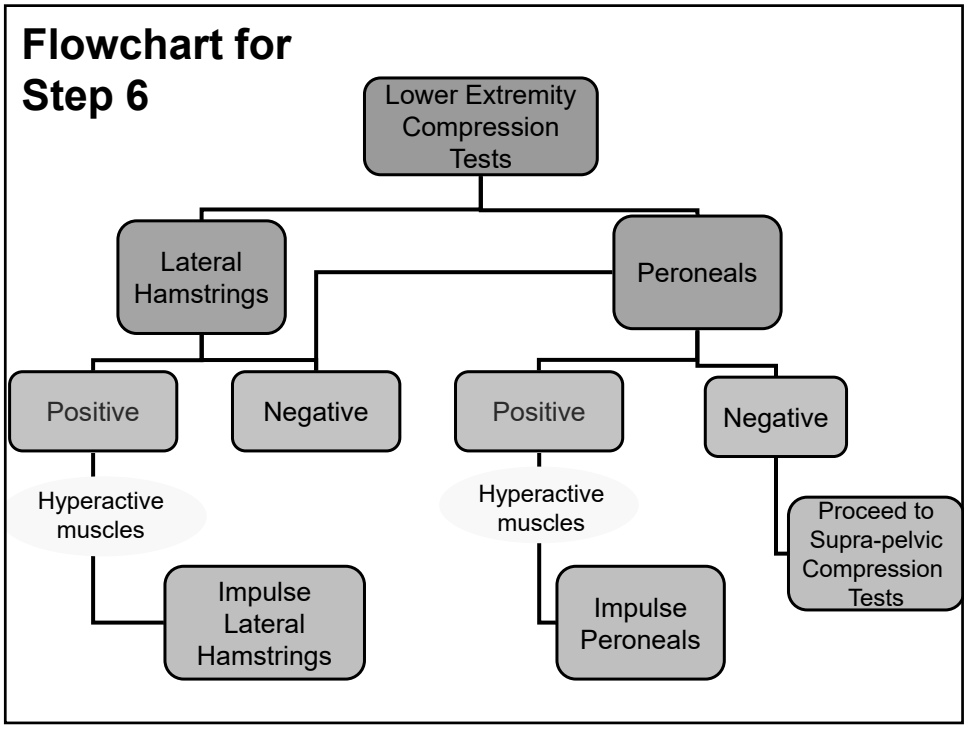

Step 6. Lower Extremity Compression Test
(for Lateral Hamstring and Peroneal m. involvemen
ImpulseAdjusting
TECHNIQUE
mechanical
INNOVATIONS
ImpulseAdjusti
TECHNIC

41


Flowchart for Step 6
Lower Extremity Compression Tests
Lateral Hamstrings
Peroneals
Positive
Negative
Positive
Negative
Hyperactive muscles
Hyperactive muscles
Proceed to Supra-pelvic Compression Tests
Impulse Lateral Hamstrings
Impulse Peroneals

42

Step 6

Lower Extremity Compression Tests

Lateral Hamstrings

Positive

Hyperactive muscles

Impulse Lateral Hamstrings

Positive Findings:
Myospasm
Tenderness
Trigger Points
Guarding

43

Lateral Hamstring Adjustments

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

Lateral Hamstring Adjustments

SCP: Taught/Tender area of muscle belly of Biceps Femoris m.

LOD: Anterior

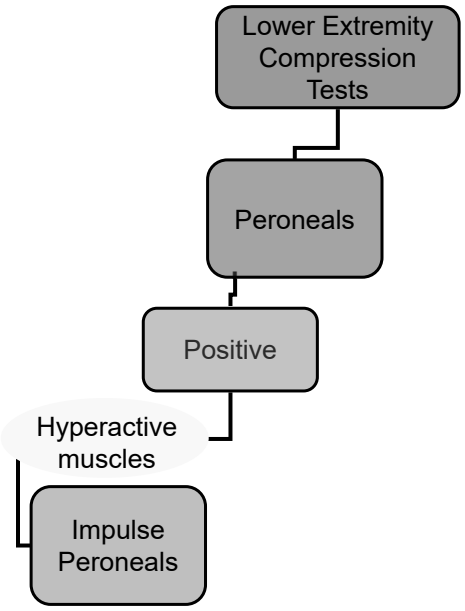
Setting: Medium or Low

ImpulseAdjusting TECHNIQUE

44

Step 6

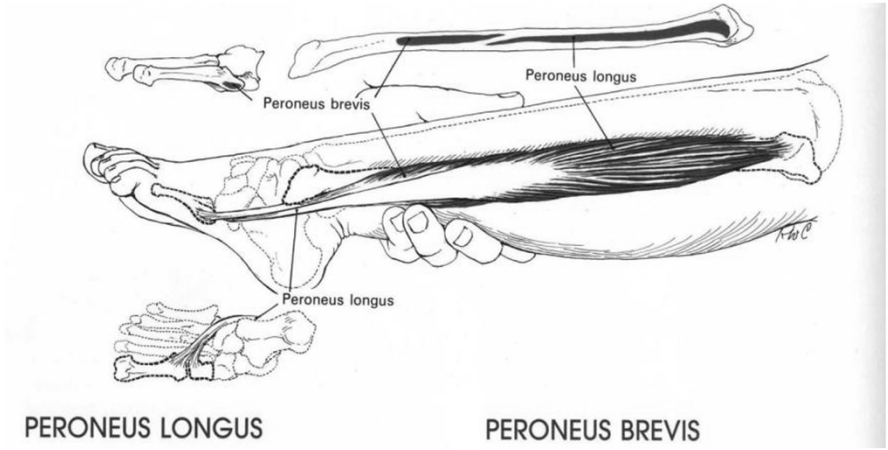
Peroneal Compression Test



45

Peroneal m.

Muscles, Testing and Function with Posture and Pain, Kendall et al, 2005, Lippincott Williams & Wilkins



46

Peroneal m. Adjustments

Peroneal m. Adjustments

SCP: Taught/Tender area of muscle belly of Peroneal m.

LOD: Anterior

Setting: Medium or Low

ImpulseAdjusting TECHNIQUE

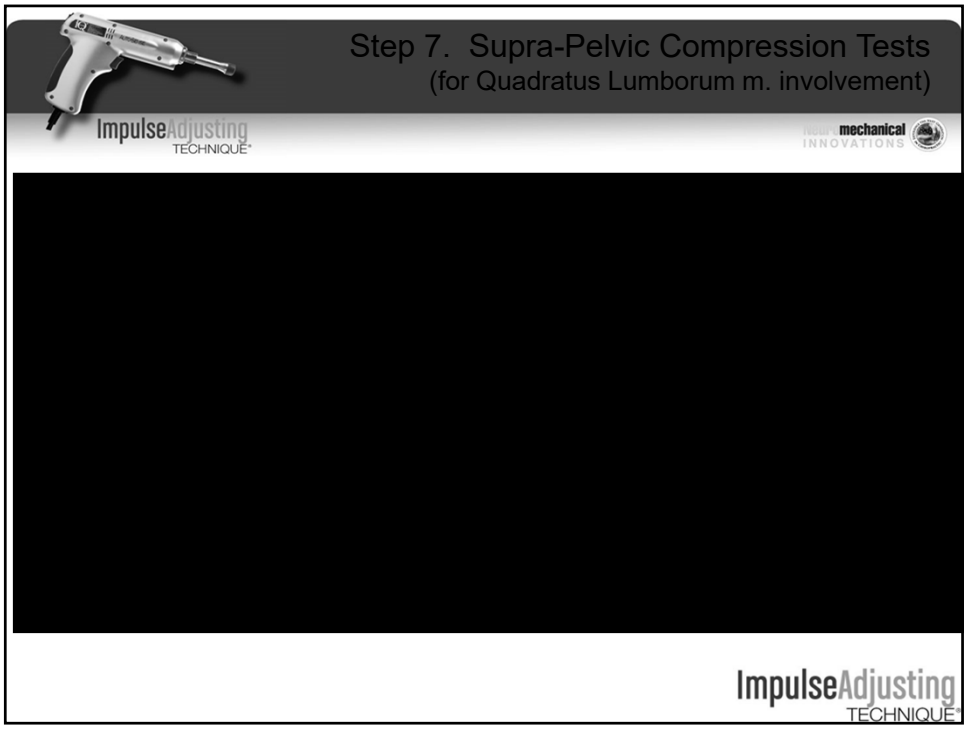
47

Step 7: Supra-Pelvic Compression Test

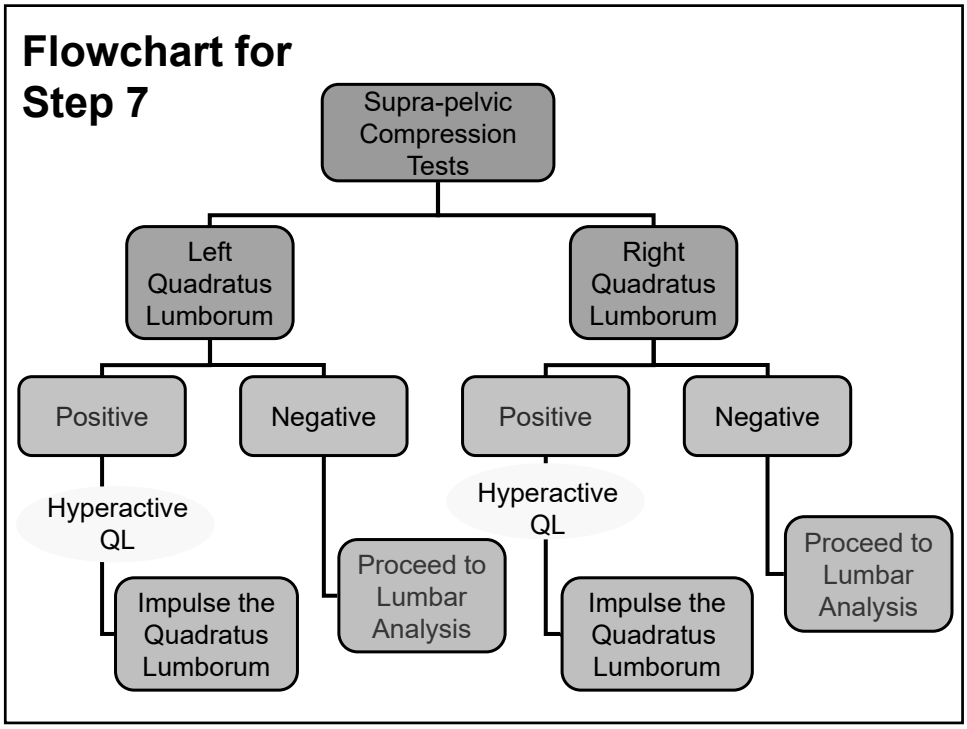
Compression test on the quadratus lumborums

ImpulseAdjusting TECHNIQUE

48


Step 7. Supra-Pelvic Compression Tests
(for Quadratus Lumborum m. involvement)
ImpulseAdjusting TECHNIQUE
mechanical INNOVATIONS
ImpulseAdjusting TECHNIQUE

49


Flowchart for Step 7
Supra-pelvic Compression Tests
Left Quadratus Lumborum
Right Quadratus Lumborum
Positive
Negative
Positive
Negative
Hyperactive QL
Proceed to Lumbar Analysis
Hyperactive QL
Proceed to Lumbar Analysis
Impulse the Quadratus Lumborum
Impulse the Quadratus Lumborum

50

Step 7

Supra-pelvic Compression Tests

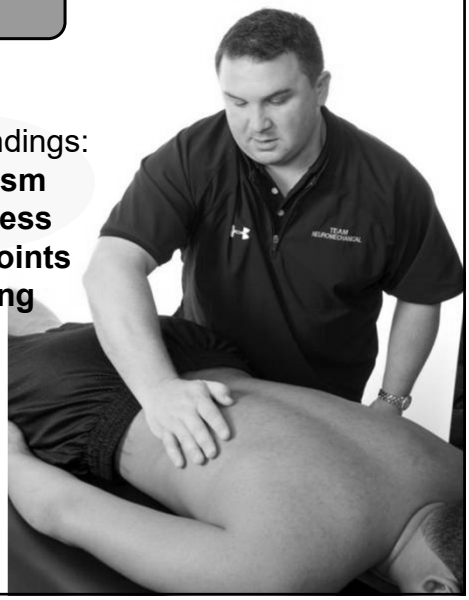
Quadratus Lumborum

Positive

Hyperactive Quadratus

Impulse the Quadratus Lumborum

Positive Findings:
Myospasm
Tenderness
Trigger Points
Guarding

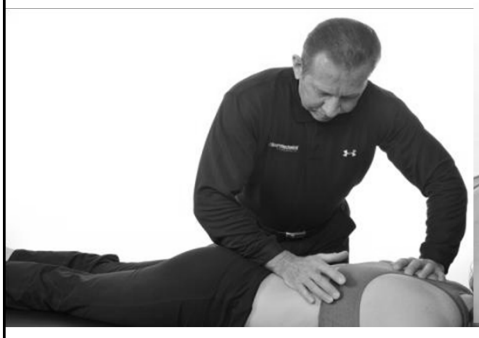


51

ImpulseAdjusting TECHNIQUE

Step 7. Supra-Pelvic Compression Tests
(for Quadratus Lumborum m. involvement)

NeuroMechanical INNOVATIONS



ImpulseAdjusting TECHNIQUE

52

Quadratus Lumborum m. Adjustment

ImpulseAdjusting TECHNIQUE

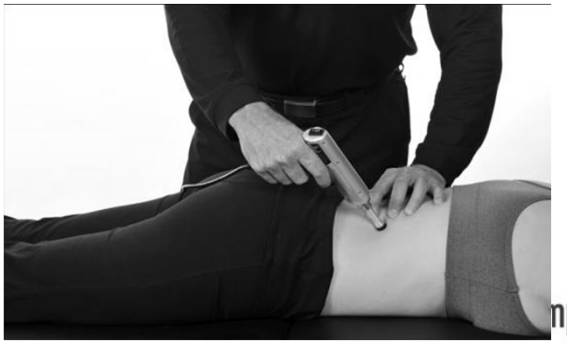
mechanical INNOVATIONS

Quadratus Lumborum m. Adjustment

SCP: Taught/Tender area of muscle belly of Quadratus Lumborum m.

LOD: Anterior

Setting: Medium or Low



ImpulseAdjusting TECHNIQUE

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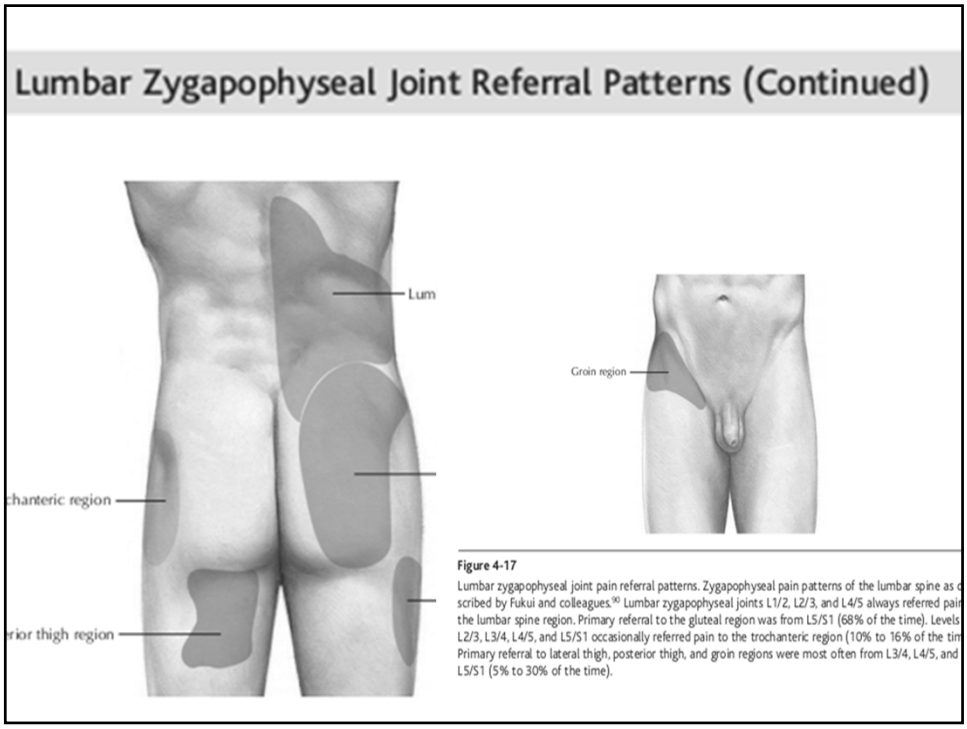
Adjustment Documentation Example

Adjust	Area	Left	Right	Bilat...	Technique	Indicated by:	Tende...	Modifier	Quality
☑	Occiput	☑	☐	☐	Impulse IQ	Indicated by reduced Cervical Rotation	☐		
☐	C1	☐	☐	☐			☐		
☑	C2	☑	☐	☐	Impulse IQ	Indicated by reduced Cervical Rotation	☐		
☐	C3	☐	☐	☐			☐		
☑	C4	☐	☐	☑	Impulse IQ	Indicated by positive Cervical Spinous Compression	☐		
☑	C5	☐	☐	☑	Impulse IQ	Indicated by positive Cervical Spinous Compression	☐		
☑	C6	☐	☐	☑	Impulse IQ	Indicated by positive Cervical Spinous Compression	☐		
☑	C7	☐	☐	☑	Impulse IQ	Indicated by positive Cervical Spinous Compression	☐		
☑	T1	☐	☐	☑	Impulse IQ	Indicated by positive Thoracic Spinous Compression	☐		
☑	T2	☐	☐	☑	Impulse IQ	Indicated by positive Thoracic Spinous Compression	☐		
☐	T3	☐	☐	☐			☐		
☐	T4	☐	☐	☐			☐		
☐	T5	☐	☐	☐			☐		
☐	T6	☐	☐	☐			☐		
☑	T7	☐	☐	☑	Impulse IQ	Indicated by positive Thoracic Spinous Compression	☐		
☑	T8	☐	☐	☑	Impulse IQ	Indicated by positive Thoracic Spinous Compression	☐		
☐	T9	☐	☐	☐			☐		
☐	T10	☐	☐	☐			☐		
☐	T11	☐	☐	☐			☐		
☐	T12	☐	☐	☐			☐		
☐	L1	☐	☐	☐			☐		
☐	L2	☐	☐	☐			☐		
☑	L3	☐	☐	☑	Impulse IQ	Indicated by positive Lumbar Spinous Compression	☐		
☑	L4	☐	☐	☑	Impulse IQ	Indicated by positive Lumbar Spinous Compression	☐		
☑	L5	☐	☐	☑	Impulse IQ	Indicated by positive Lumbar Spinous Compression	☐		
☑	Right SI	☐	☑	☐	Impulse IQ	Indicated by pain on palpation	☑	mild	(quality: sharp)
☑	Left SI	☑	☐	☐	Impulse IQ	Indicated by pelvic asymmetry	☑	mild	(quality: sharp)
☑	Sacrum	☐	☑	☐	Impulse IQ	Indicated by pelvic asymmetry	☐		
☐	Coccyx	☐	☐	☐			☐		
☐	Scapula	☐	☐	☐			☐		
☑	Trochanter	☐	☐	☑	Impulse IQ	Indicated by joint hypomobility	☐		
☐	Quadratus Lumb...	☐	☐	☐			☐		

54

The Lumbar Spine Region
NEUROMECHANICAL INNOVATIONS
EXPERIENCE THE NEXT GENERATION IN CHIROPRACTIC

55


Lumbar Zygapophyseal Joint Referral Patterns (Continued)
Lum
chanteric region
rior thigh region
Groin region
Figure 4-17
Lumbar zygapophyseal joint pain referral patterns. Zygapophyseal pain patterns of the lumbar spine as d
scribed by Fukui and colleagues.[90] Lumbar zygapophyseal joints L1/2, L2/3, and L4/5 always referred pai
the lumbar spine region. Primary referral to the gluteal region was from L5/S1 (68% of the time). Levels
L2/3, L3/4, L4/5, and L5/S1 occasionally referred pain to the trochanteric region (10% to 16% of the tim
Primary referral to lateral thigh, posterior thigh, and groin regions were most often from L3/4, L4/5, and
L5/S1 (5% to 30% of the time).

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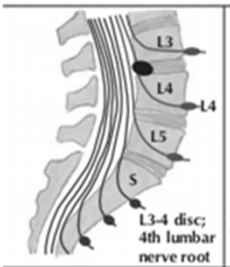
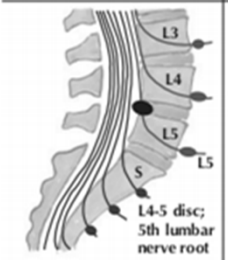
Neurological Examination

Diagnostic Utility of the Sensation, Manual Muscle Testing, and Reflexes for Lumbar Spinal Stenosis

Level of Herniation	Pain	Numbness	Weakness	Atrophy	Reflexes
 L3-4 disc; 4th lumbar nerve root	Lower back, hip, posterolateral thigh, anterior leg	Antero-medial 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	Dorsifexion of great toe and foot; difficulty walking on heels; foot drop may occur	Minor	Changes uncommon (absent or diminished posterior tibial reflex)

57

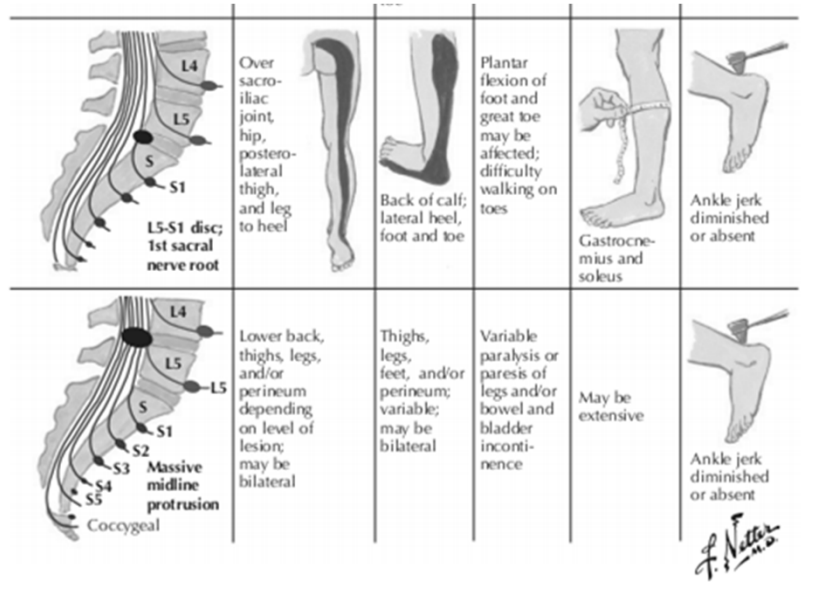


Figure 4-20

Clinical features of herniated lumbar nucleus pulposus.

58

During specific movements, range of motion and movement of pain noted. Movement of pain from peripheral to central location (centralization) predicts outcome and appropriateness of therapy.

Figure 4-30
Centralization of pain.

Test and Study Quality	Description and Positive Findings	Population	Reference Standard	Sens	Spec	+LR	−LR
Centralization[34] ◆	Centralization present if pain in the furthermost region from midline was abolished or reduced with a McKenzie-styled repeated motion examination	69 patients with persistent low back pain with or without referred leg pain	At least 1 painful disc adjacent to a nonpainful disc with discography	.40 (.28, .54)	.94 (.73, .99)	6.9 (1.0, 47.3)	.63 (.49, .82)

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Postural Assessment

Reliability of Postural Assessment

ICC or κ	Interpretation
.81-1.0	Substantial agreement
.61-.80	Moderate agreement
.41-.60	Fair agreement
.11-.40	Slight agreement
.0-.10	No agreement

Test and Study	Description and Positive Findings	Population	Inter-examiner Reliability
Forward head[34]	"Yes" if the patient's external auditory meatus was anteriorly deviated (anterior to the lumbar spine)	22 patients with mechanical neck pain	κ = −.10 (−.20,-.00)
Excessive shoulder protraction[34]	"Yes" if the patient's acromions were anteriorly deviated (anterior to the lumbar spine)		κ = .83 (.51, 1.0)
C7-T2 excessive kyphosis[34]	Recorded as "normal" (no deviation), "excessive kyphosis," or "diminished kyphosis." *Excessive kyphosis* was defined as an increase in the convexity, and *diminished kyphosis* was defined as a flattening of the convexity of the thoracic spine (at each segmental group)		κ = .79 (.51, 1.0)
T3-5 excessive kyphosis[34]			κ = .69 (.30, 1.0)
T3-5 decreased kyphosis[34]			κ = .58 (.22, .95)
T6-10 excessive kyphosis[34]			κ = .90 (.74, 1.0)
T6-10 decreased kyphosis[34]			κ = .90 (.73, 1.0)
Kyphosis[35]	With patient standing, examiner inspects posture from the side. Graded as "present" or "absent"	111 adults age ≥ 60 with chronic low back pain and 20 asymptomatic patients	κ = .21
Scoliosis[35]	With patient standing, examiner runs finger along spinous processes. Patient bends over and examiner assesses height of paraspinal musculature. Graded as "present" or "absent"		κ = .33
Functional leg length discrepancy[35]	Compare bilateral iliac crest height with patient standing. Graded as "symmetrical" or "asymmetrical"		κ = .00

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Passive Intervertevbral Motion

Reliability of Assessing Limited or Excessive Passive Intervertebral Motion

ICC or κ	Interpretation
.81-1.0	Substantial agreement
.61-.80	Moderate agreement
.41-.60	Fair agreement
.11-.40	Slight agreement
.0-.10	No agreement

Test and Study	Description and Positive Findings	Population	Reliability
Upper lumbar segmental mobility[36]	With patient prone, examiner applies a posteroanterior force to the spinous process and lumbar facets of each lumbar vertebra. Mobility of each segment is judged as "normal" or "restricted"	39 patients with low back pain	(Spinous) Inter-examiner κ = **.02 (−.27, .32)** (Left facet) Inter-examiner κ = **.17 (−.14, .48)** (Right facet) Inter-examiner κ = **−.01 (−.33, .30)**
Lower lumbar segmental mobility[36]			(Spinous) Inter-examiner κ = **−.05 (−.36, .27)** (Left facet) Inter-examiner κ = **−.17 (−.41, .06)** (Right facet) Inter-examiner κ = **−.12 (−.41, .18)**
Identifying the least mobile segment[37]	With patient prone, examiner applies a posteroanterior force to the spinous process of each lumbar vertebra	29 patients with central low back pain	Inter-examiner κ = **.71 (.48, .94)**
Identifying the most mobile segment[37]			Inter-examiner κ = **.29 (−.13, .71)**
Posterior to anterior (PA) stiffness[38]			Intra-examiner κ = **.54** Intra-examiner (±1 level) κ = **.64** Inter-examiner κ = **.23** Inter-examiner (±1 level) κ = **.52**

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Passive Intervertebral Motion (continued)

Reliability of Assessing Limited or Excessive Passive Intervertebral Motion

ICC or κ	Interpretation
.81-1.0	Substantial agreement
.61-.80	Moderate agreement
.41-.60	Fair agreement
.11-.40	Slight agreement
.0-.10	No agreement

Test and Study	Description and Positive Findings	Population	Reliability
Determination of segmental fixations[40]	Passive motion palpation is performed and the segment is considered fixated if a hard end-feel is noted during the assessment	60 asymptomatic volunteers	Intra-examiner κ ranged from **−.09 to .39** Inter-examiner κ ranged from **−.06 to .17**
Passive motion palpation[41]		21 symptomatic and 25 asymptomatic subjects	Inter-examiner κ = ranged from **−.03 to .23** with a mean of .07
Segmental mobility testing[42]	With patient side-lying with hips and knees flexed, examiner assesses mobility while passively moving the patient. Examiner determines whether mobility of the segment is "decreased," "normal," or "increased"	71 patients with low back pain	Inter-examiner κ = **.54**
Hypermobility at any level[31]	With patient prone, examiner applies a posteroanterior force to the spinous process of each lumbar vertebra. Mobility of each segment is judged as "normal," "hypermobile," or "hypomobile"	49 patients with low back pain referred for flexion-extension radiographs	Inter-examiner κ = **.48 (.35, .61)**
Hypomobility at any level[31]			Inter-examiner κ = **.38 (.22, .54)**
Determination of posteroanterior spinal stiffness[43]	Five raters tested lumbar spinal levels for posteroanterior mobility and graded each on an 11-point scale ranging from "markedly reduced stiffness" to "markedly increased stiffness"	40 asymptomatic individuals	Inter-examiner ICC in the first study = **.55 (.32, .79)** Inter-examiner ICC in the second study = **.77 (.57, .89)**
Posteroanterior mobility testing[44]	With the patient prone, examiner evaluates posteroanterior motion mobility. Mobility is scored on a 9-point scale ranging from "severe excess motion" to "no motion," and the presence of pain is recorded	18 patients with low back pain	Inter-examiner ICC = **.25 (.00, .39)**

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Posteroanterior mobility testing[44]	With the patient prone, examiner evaluates posteroanterior motion mobility. Mobility is scored on a 9-point scale ranging from "severe excess motion" to "no motion," and the presence of pain is recorded	18 patients with low back pain	Inter-examiner ICC = **.25 (.00, .39)**
Segmental mobility testing[45]	With patient prone, examiner applies an anteriorly directed force over the spinous process of the segment to be tested. Examiner grades the mobility as "hypermobile," "normal," or "hypomobile"	63 patients with current low back pain	Inter-examiner κ ranged from **−.20 to .26** depending on level tested
Identification of a misaligned vertebra[41]	Static palpation is used to determine the relationship of one vertebra to the vertebra below	21 symptomatic and 25 asymptomatic subjects	Inter-examiner κ ranged from **−.04 to .03** with a mean of **.00**
Detection of a segmental lesion T11-L5/S1[46]	Two clinicians used visual postural analysis, pain descriptions, leg length discrepancy, neurological examination, motion palpation, static palpation, and any special orthopaedic tests to determine the level of segmental lesion.	19 patients with chronic mechanical low back pain	Intra-examiner κ = **−.08 to .43** Inter-examiner κ = **−.16 to .25**

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Passive Intervertebral Motion

Reliability of Assessing Painful Passive Intervertebral Motion

ICC or κ	Interpretation
.81-1.0	Substantial agreement
.61-.80	Moderate agreement
.41-.60	Fair agreement
.11-.40	Slight agreement
.0-.10	No agreement

Figure 4-26
Assessment of posteroanterior segmental mobility.

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Figure 4-26
Assessment of posteroanterior segmental mobility.

Test and Study	Description and Positive Findings	Population	Reliability	
			Intra-examiner	Inter-examiner
Spring test T10-T7[47]	With patients in the prone position the therapist applies a posteroanterior force to the spinous processes of T7-L5. The pressure of each force is held for 20 seconds. Considered positive if the force produces pain	84 subjects, of whom 53% reported experiencing low back symptoms within the last 12 months	κ = .73 (.39-1.0)	κ = .12 (−.18 -.41)
Spring test L2-T11[47]			κ = .78 (.49-1.0)	κ = .36 (.07- .66)
Spring test L5-L3[47]			κ = .56 (.18-.94)	κ = .41 (.12- .70)
Pain with upper lumbar mobility testing[36]	With patient prone, examiner applies a posteroanterior force to the spinous processes and lumbar facets of each lumbar vertebra. Response at each segment is judged as "painful" or "not painful"	39 patients with low back pain	(Spinous) Inter-examiner κ = .21 (−.10, .53) (Left facet) Inter-examiner κ = .46 (.17, .75) (Right facet) Inter-examiner κ = .38 (.06, .69)	
Pain with lower lumbar mobility testing[36]			(Spinous) Inter-examiner κ = .57 (.32, .83) (Left facet) Inter-examiner κ = .73 (.51, .95) (Right facet) Inter-examiner κ = .52 (.25, .79)	
Pain provocation[45]	With patient prone, examiner applies an anteriorly directed force over the spinous processes of the segment to be tested. Considered positive if pain is reproduced	63 patients with current low back pain	Inter-examiner κ ranged from .25 to .55 depending on the segmental level tested	
Pain during mobility testing[31]		49 patients with low back pain referred for flexion-extension radiographs	Inter-examiner κ = .57 (.43, .71)	

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LITERATURE REVIEW

MANUAL EXAMINATION OF THE SPINE: A SYSTEMATIC CRITICAL LITERATURE REVIEW OF REPRODUCIBILITY

Mette Jensen Stochkendahl, DC,[a] Henrik Wulff Christensen, DC, MD, PhD,[b] Jan Hartvigsen, DC, PhD,[c] Werner Vach, PhD,[d] Mitchell Haas, DC, MA,[e] Lise Hestbaek, DC, PhD,[f] Alan Adams, DC, MS, MSEd,[g] and Gert Bronfort, DC, PhD[h]

ABSTRACT

Objective: Poor reproducibility of spinal palpation has been reported in previously published literature, and authors of recent reviews have posted criticism on study quality. This article critically analyzes the literature pertaining to the inter- and intraobserver reproducibility of spinal palpation to investigate the consistency of study results and assess the level of evidence for reproducibility.

Methods: Systematic review and meta-analysis were performed on relevant literature published from 1965 to 2005, identified using the electronic databases MEDLINE, MANTIS, and CINAHL and checking of reference lists. Descriptive data from included articles were extracted independently by 2 reviewers. A 6-point scale was constructed to assess the methodological quality of original studies. A meta-analysis was conducted among the high-quality studies to investigate the consistency of data, separately on motion palpation, static palpation, osseous pain, soft tissue pain, soft tissue changes, and global assessment. A standardized method was used to determine the level of evidence.

Results: The quality score of 48 included studies ranged from 0% to 100%. There was strong evidence that the interobserver reproducibility of osseous and soft tissue pain is clinically acceptable ($\kappa \geq 0.4$) and that intraobserver reproducibility of soft tissue pain and global assessment are clinically acceptable. Other spinal procedures are either not reproducible or the evidence is conflicting or preliminary. (J Manipulative Physiol Ther 2006;29:475-485)

Key Indexing Terms: *Reproducibility of Results; Palpation; Literature Review; Diagnostic Tests; Spine; Meta-Analysis*

66

Bilateral
Knee Flexion Test

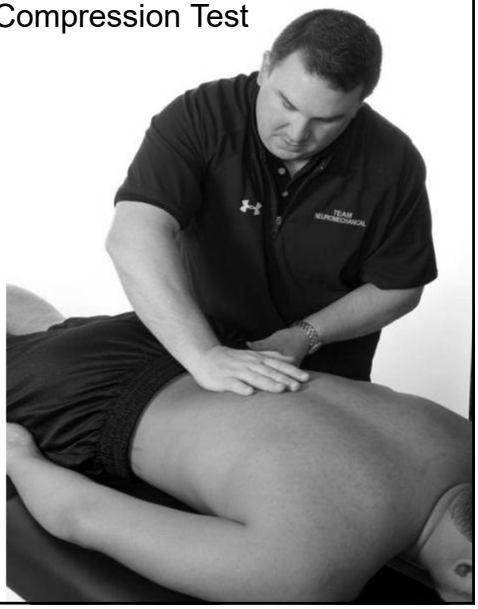
Positive

Central
Low Back
Pain

Lumbo-Sacral
Involvement

Test and Lumbo-
Sacral Joint
(Dual Styluses)

Confirm with Lumbar
Spinous Compression Test



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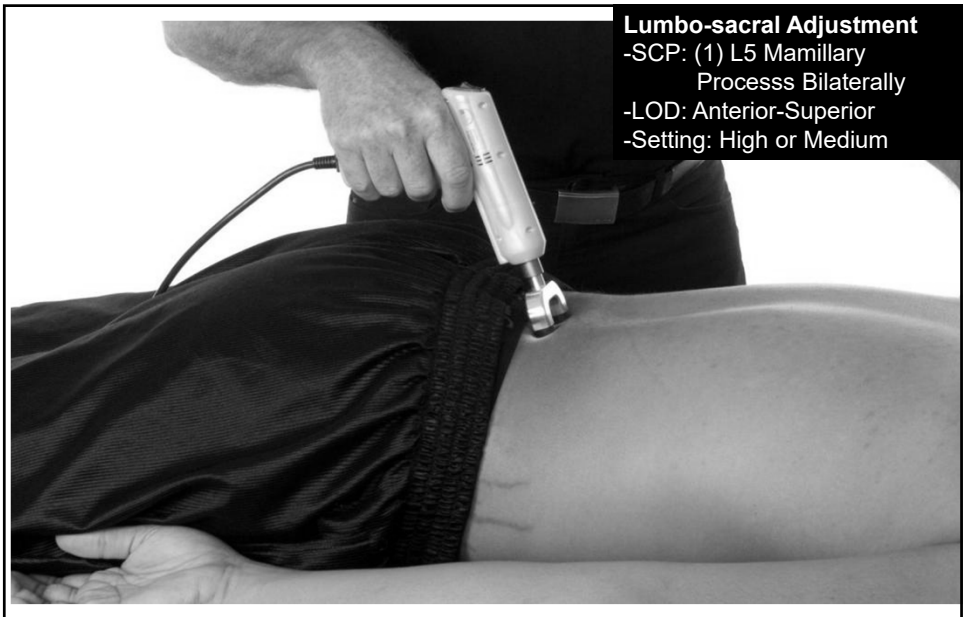
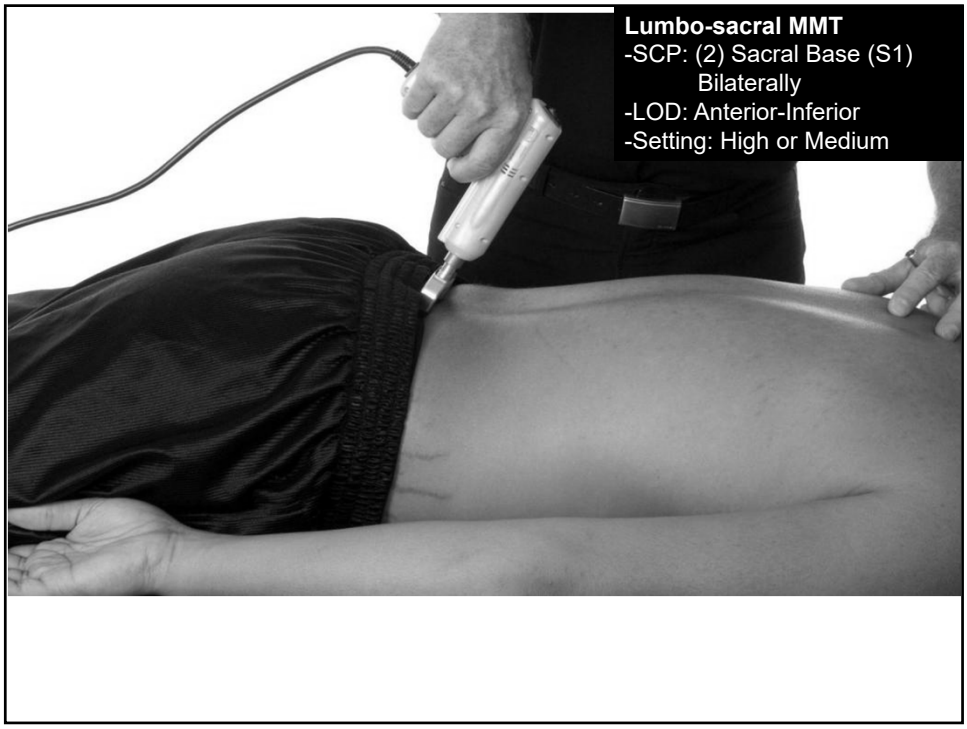


Lumbo-sacral Adjustment
-SCP: (1) L5 Mamillary
Processs Bilaterally
-LOD: Anterior-Superior
-Setting: High or Medium

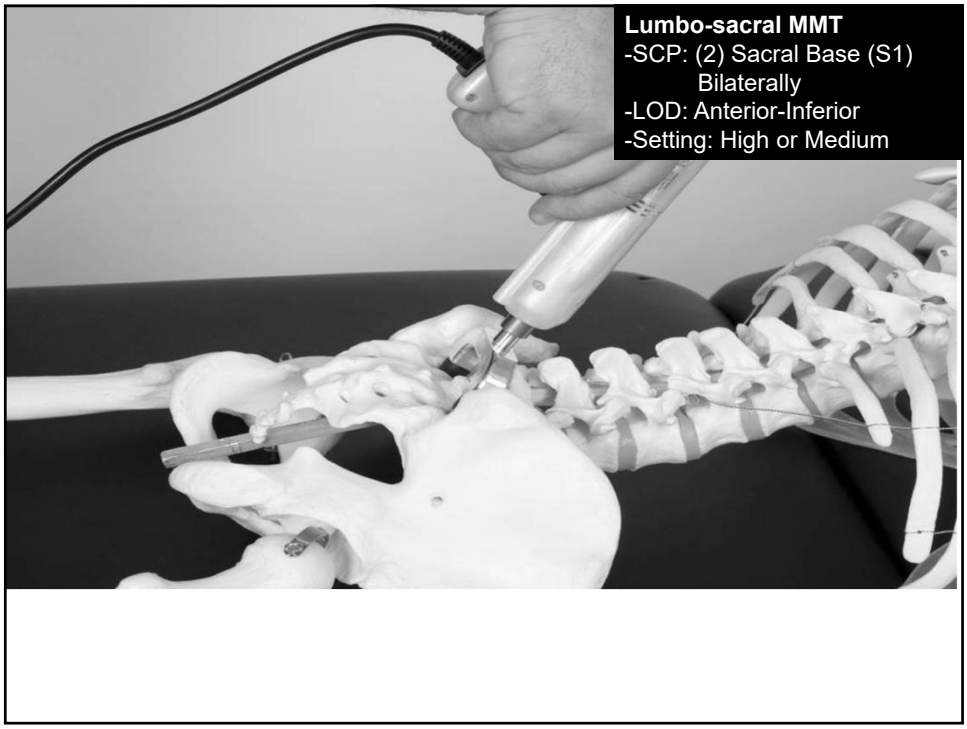
68

Lumbo-sacral MMT
-SCP: (1) L5 Mamillary Processs Bilaterally
-LOD: Anterior-Superior
-Setting: High or Medium

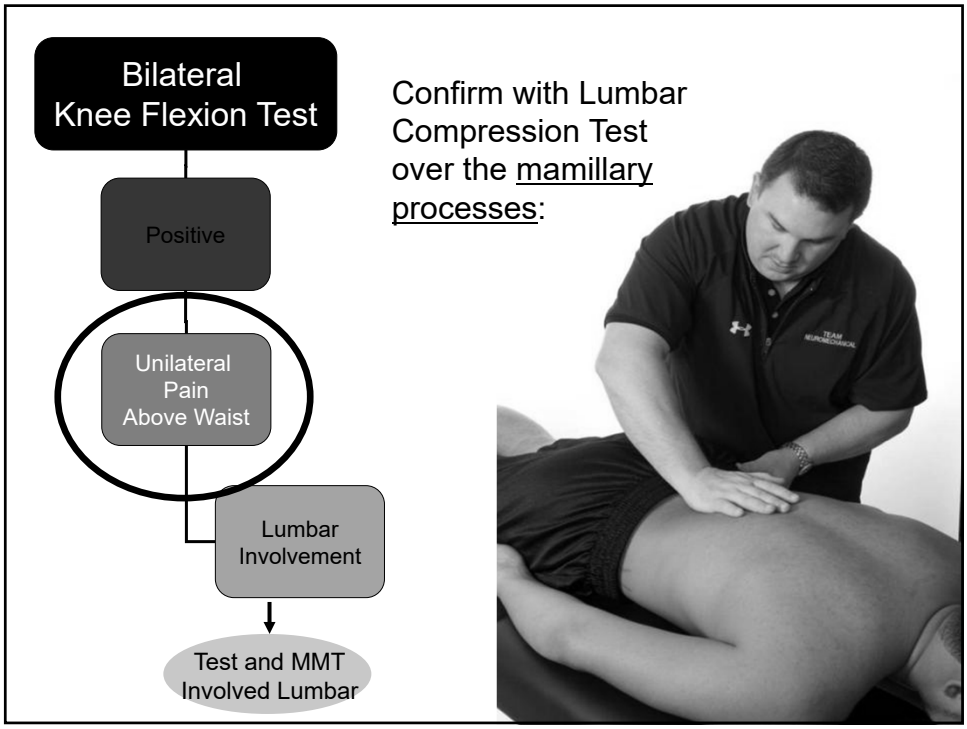
69


Lumbo-sacral MMT
-SCP: (2) Sacral Base (S1) Bilaterally
-LOD: Anterior-Inferior
-Setting: High or Medium

70


Lumbo-sacral MMT
-SCP: (2) Sacral Base (S1)
Bilaterally
-LOD: Anterior-Inferior
-Setting: High or Medium

71


Bilateral
Knee Flexion Test
Positive
Unilateral
Pain
Above Waist
Lumbar
Involvement
Test and MMT
Involved Lumbar
Confirm with Lumbar
Compression Test
over the mamillary
processes:

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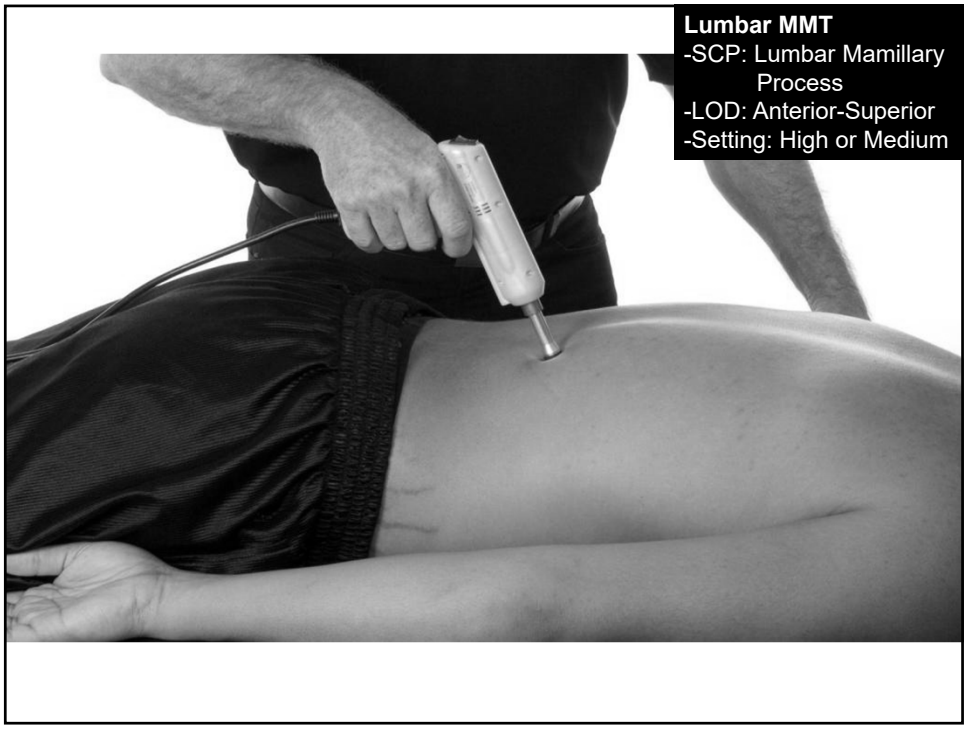
Lumbar MMT
-SCP: Lumbar Mamillary Process
-LOD: Anterior-Superior
-Setting: High or Medium

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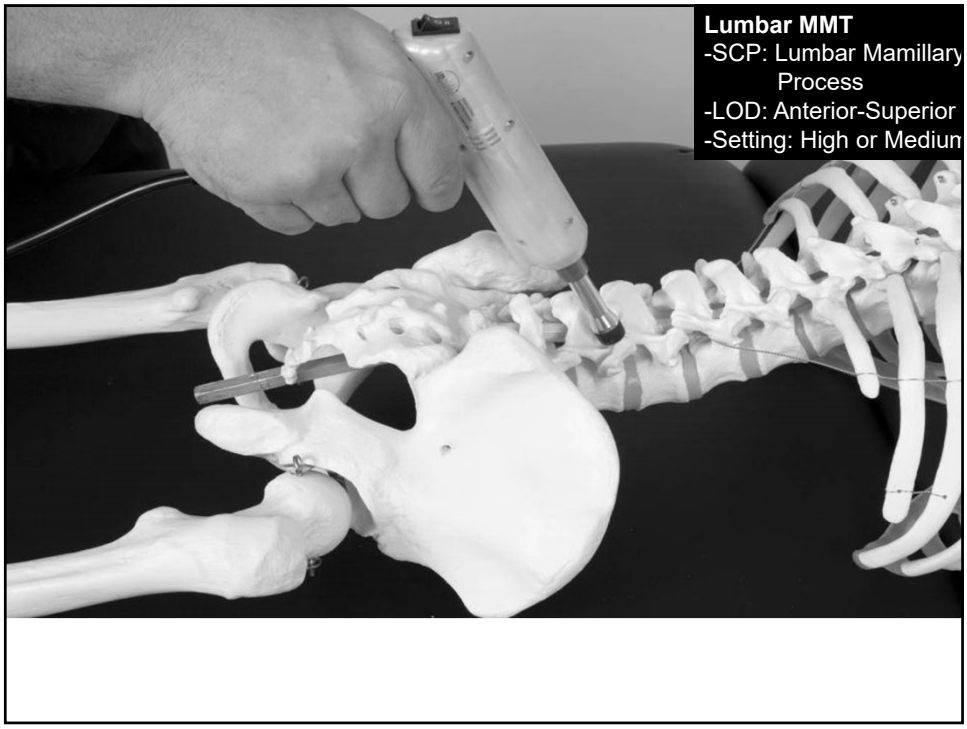
Lumbar MMT
-SCP: Lumbar Mamillary Process
-LOD: Anterior-Superior
-Setting: High or Mediun

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Lower Thoracic Spinous Compression Test:

ImpulseAdjusting TECHNIQUE

mechanical INNOVATIONS

- **Proceed from lumbar spine up the thoracic spine to the apex of the thoracic curve (usually around T6-7)**

- **Rationale for spinous compression (producing posterior to anterior movement) is that the zygapophyseal joints in the lower thoracic spine are in the sagittal plane (like the lumbar spine facets) allowing mostly flexion.**

- **Amount of flexion per segment increases from approx 4 degrees at T6-7 to 12 degrees at T11-12.**

- **Rotation is very limited, especially in the lowest levels.**

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