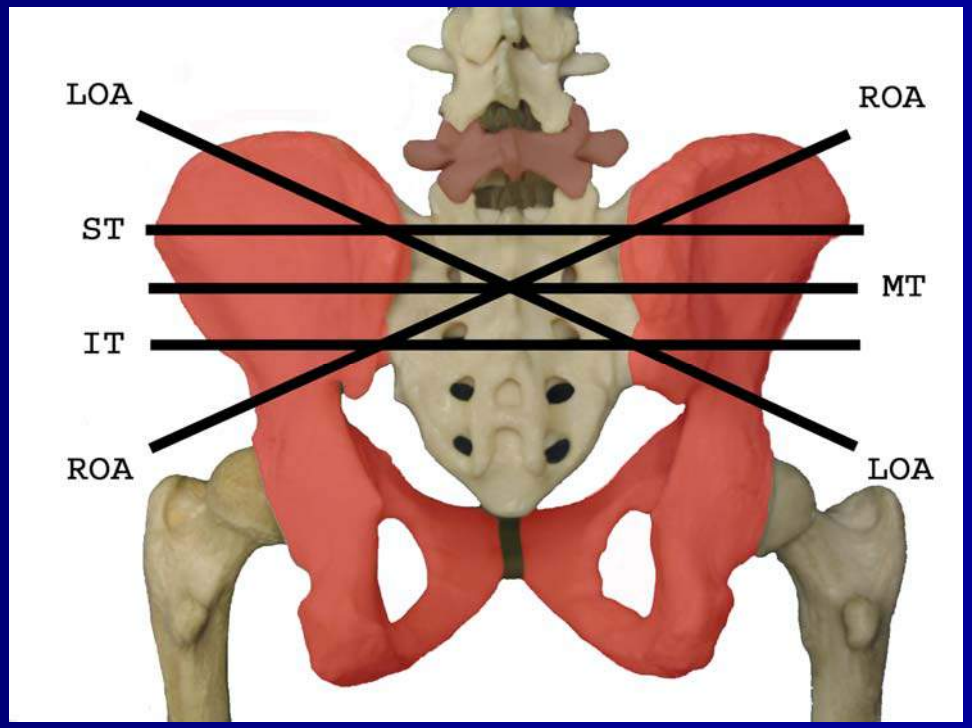
Treatment of Sacroiliac Joint Dysfunction

Movement of sacrum on ilium

Sacroiliac Joint Axes

- Superior
- Middle
- Inferior
- Right Oblique
- Left Oblique



Sacroiliac Joint Movement

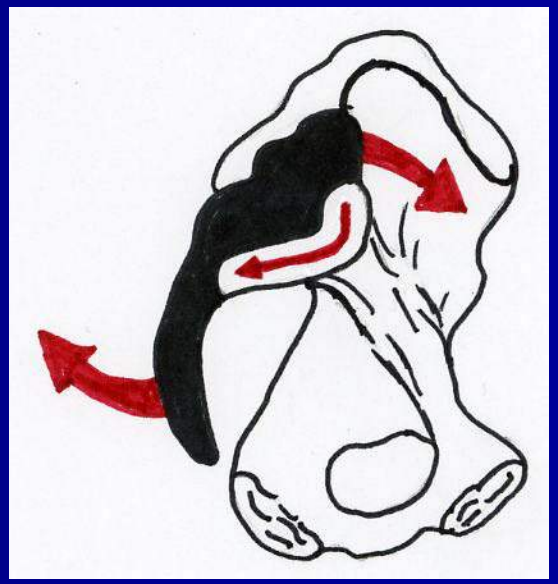
- Nutation: Anterior nutation or flexion
- Counternutation: Posterior nutation or extension
- Forward rotation around an oblique axis
- Backward rotation around an oblique axis

Sacroiliac Joint Movements

- Physiologic
  - Left sacral torsion on left oblique axis
  - Right sacral torsion on right oblique axis
  - Bilateral anterior sacral nutation
  - Bilateral posterior sacral nutation
  - Anterior sacral nutation with exhalation
  - Posterior sacral nutation with inhalation
- Non-physiologic
  - Left sacral torsion on right oblique axis
  - Right sacral torsion on left oblique axis
  - Left unilateral anterior nutation
  - Right unilateral anterior nutation
  - Left unilateral posterior nutation
  - Right unilateral posterior nutation

Sacral Nutation

- "Sacral locking"
- Base of sacrum moves into pelvis
  - Inferoposterior glide of articular surface of sacrum on ilium
  - Coronal axis of interosseous ligament
  - Iliac bones approximate, ischial tuberosities spread
  - Limited by interosseous, ant. sacroiliac, sacrotuberous and sacrospinous lig
- Bilateral
  - Early trunk extension
  - End range trunk flexion
  - Exhalation
- Unilateral
  - Hip flexion



Sacral Counternutation

- "Sacral unlocking"
- Backward motion of base of sacrum out of pelvis
  - Anterosuperior glide of articular surface of sacrum on illium
  - Coronal axis of interosseous ligament
  - Iliac bones spread, ischial tuberosities approximate
  - Limited by long post sacroiliac ligament and multifidus contraction
- Bilateral
  - Early trunk flexion
  - End of trunk extension
  - Inhalation
- Unilateral
  - Hip extension

Reciprocal Movement at Lumbosacral Junction

- Flexion of L5S1
  - Sacral base moves posteriorly into extension (counternutates)
- Extension of L5S1
  - Sacral base moves anteriorly into flexion (nutates)
- Right rotation and left sidebending of L5
  - Sacral base rotates to left and side bends right

Muscle Functions

- Piriformis
  - Anterior tilt and rotate sacrum to opposite side
    - Assisted by ipsilateral gluteus maximus
- Contralateral latissimus dorsi and gluteus maximus through LDF
  - Nutation of sacrum and extension of LS junction
- Long head of biceps
  - Backward tilt and rotate sacrum to same side
- Longissimus and multifidus
  - Pull sacral base superiorly and posteriorly thru dorsal ligaments

Normal Gait Mechanics

- Innominate
  - Right innominate rotates anteriorly
  - Sacrum rotates toward it and sidebends away from it
- Sacrum
  - Sacrum moves into right forward torsion on right oblique axis the returns to neutral
- L5
  - As sacrum right rotates and left sidebends, L5 left rotates and right sidebends

Pelvic Girdle Function

- Form closure
  - Bones, joints, ligaments
- Force closure
  - Muscles, fascia
- Motor control
  - Neural patterning
- Emotions
  - Awareness

Impairments

- Excessive articular compression
  - Fusion (AS)
  - Capsular fibrosis
  - Overactivation of global myofascial system
  - Joint fixation (underlying instability)
- Insufficient articular compression
  - Ligamentous laxity
  - Underactivity of local myofascial system

Lee

Somatic Dysfunction

- Function
  - Stability and motion of SI joints result of shape of joint surfaces (form closure) and altering of ligamentous tension in response to changes of muscle tone (force closure) (Isaacs & Bookhout)
- Dysfunction
  - Imbalance of tension and tone between muscles and ligaments which locks SI joint and prevents normal function (Isaacs & Bookhout)
- ARTT
  - Asymmetry of position, restricted motion, tissue texture, tenderness

Sacroiliac Somatic Dysfunctions

- Forward sacral torsion
- Backward sacral torsion
- Bilateral sacral anterior nutation
- Bilateral sacral posterior nutation
- Unilateral sacral anterior nutation
- Unilateral sacral posterior nutation

Symptoms

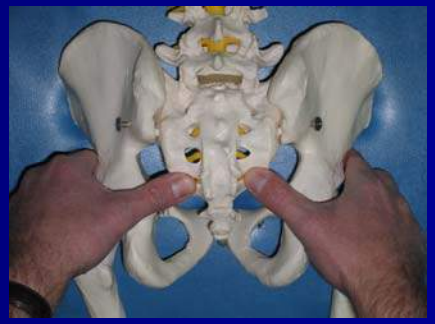
- Stiffness and pain with walking
- Pain opposite side with walking – SI
- Pain same side with walking – IS
- Unilateral pain below L5
- Pain with sit to stand
- Coccydynia (torsions)
- Groin pain

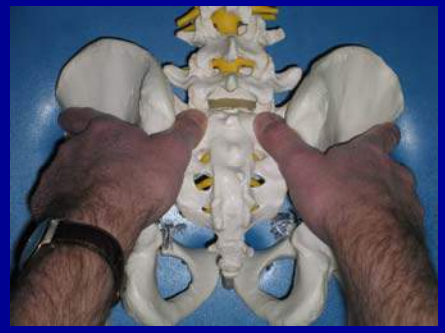
Examination

- Positional tests
- Motion tests
- Passive mobility tests
- Pain provocation tests
- Palpation

Positional Tests

- Landmarks
  - ASIS
  - PSIS
  - Sacral sulcus
  - ILA
  - Medial malleoli (prone)
  - L5
  - Pubic tubercle
- Positions
  - Neutral, extended and flexed





Active Motion Tests

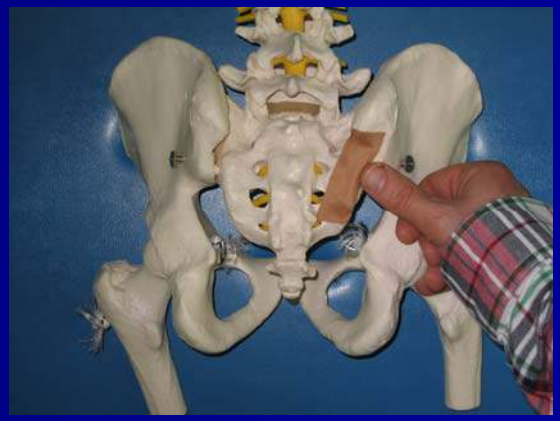
- Standing flexion test
- Stork test
  - Gillet's test
- Seated flexion test
  - Piedallu's test

Passive Mobility Testing

- Osteokinematic
  - Nutation/counternutation
    - Prone
  - Anterior/posterior innominate rotation
    - Sidelying
- Arthrokinematic
  - Inferoposterior glide
    - Anterior innominate rotation
  - Superoanterior glide
    - Posterior innominate rotation
  - Horizontal translation
    - Squish test
  - Vertical translation
- Lumbar spring test

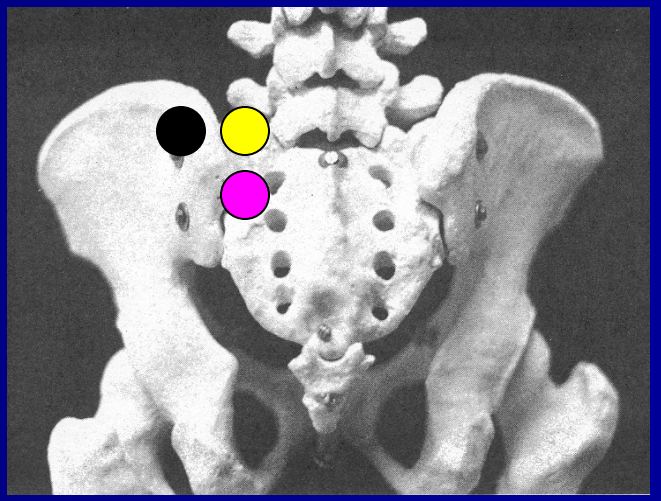
Palpation

- Tension (ligaments)
  - Sacrotuberous
  - Long dorsal ligament
- Tone (muscles)
  - Piriformis
  - Psoas/Iliacus
  - Coccygeus
  - Gluteus maximus
  - Latissimus dorsi
  - Multifidus
  - Erector spinae
- Tenderness



Tenderness

- L5S1 – yellow
- Lumbar – black
- SI joint - blue



Pain Provocation Tests

- Anterior gapping (Distraction)
- Posterior gapping (Compression)
- Gaenslen's
- Thigh thrust
- Sacral thrust





Standing

- Anatomic landmarks
- Standing flexion test
  - Symmetrical superior movement of PSIS's
- Stork test (Gillet's march test)
  - PSIS should drop (also move laterally after 90°)
- Hip drop test
  - Anterior nutation on side of bent knee, rotate toward lumbar concavity
- Side bending
  - Anterior nutation on side of convexity, rotate toward lumbar concavity
  - Anterior innominate rotation (side of concavity), posterior innominate rotation (side of convexity)

Seated

- Seated forward flexion test
  - Symmetrical superior/anterior movement of PSIS's
  - Positive seated flexion test indicates sacroiliac dysfunction
  - Indicates dysfunctional side
- Palpation
  - ILA's
    - Symmetrical in upright, flexed and extended positions
  - Lumbar laminae (L5) and transverse processes
    - Symmetrical

Seated Flexion Test

- If ILA's become symmetrical
  - Rule out
    - Unilateral anterior or posterior sacral nutations
    - Forward sacral torsion
- If positive on left
  - Rule out
    - Bilateral anterior or posterior nutations
  - Could be
    - Left unilateral anterior nutation
    - ROR forward sacral torsion
    - LOR backward sacral torsion

Supine

- Palpate
  - ASIS's, pubic tubercles, medial malleoli
    - Helps define etiology
    - Is it purely sacral or mixed problem (iliac and pubic dysfunction)
- Squish test
  - Symmetrical resistance
- Pain provocation tests
  - Gaenslen's test
  - SI compression/distraction
    - Compression in sidelying
  - Thigh thrust
- ASLR (Active SLR test)

Prone

- Palpation
  - Sacral base and ILA's
    - Prone and prone-on elbows positions
  - Malleoli position
  - Long dorsal sacroiliac joint ligament
  - Sacrotuberous ligament
  - Muscles
    - Piriformis, gluteal, paraspinal
- Mobility
  - Spring test
    - Lumbar
    - Sacral (transverse axis & oblique axis)
- Pain provocation test
  - Sacral thrust

Forward Sacral Torsion

- Forward rotation around oblique axis
  - 85% LOL (common in R handed people)
- Imbalance between piriformis and hip rotator muscles. After posterolateral disc.
- Symptoms
  - No low back pain, unless associated with ERS
  - Piriformis symptoms, gluteal pain
  - Occasional sciatica
  - Standing, walking and stair climbing
  - Little or no pelvic restriction with gait
    - In gait, on R heel strike, sacrum turns L and L5 turns R
    - At R mid-stance, sacrum rotates right on ROA, L5 rotates L and SB R
- Must treat lumbar non-neutral dysfunctions first

Backward Sacral Torsion

- Backward rotation around oblique axis
  - 85% LOR
- Lumbar sidebending and rotation to same side while fully flexed. Locks with attempt to return to upright position.
  - Left L/S SB/ROT in F will cause right sacral rotation on LOA
  - “the well bent over and the cripple stood up” syndrome
- Symptoms:
  - Testicle pain, heel burning, lateral knee pain, back of leg numb; can’t lie side of torsion; can’t lie prone; morning stiffness; inability to cross legs; inability to sweep or vacuum; pain with walking; sit-to-stand; rising from FB position
- Must treat non-neutral lumbar dysfunction first

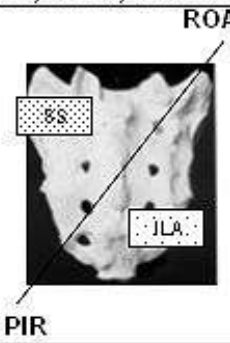
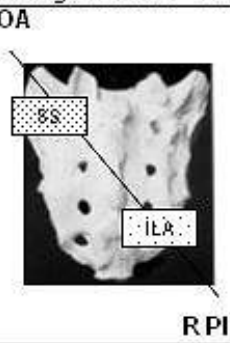
Sacral Torsion Diagnosis

- Sulcus deep and ILA posterior on opposite sides
- Sulcus determines torsion
  - Left sulcus deep is RST
- Axis and direction determination
  - Piriformis
    - Left tight creates ROA
    - Positive left seated flexion test indicates tight left piriformis
  - Spring test positive in backward, negative in forward
  - Forward torsions become asymmetric in flexion and symmetric in extension (ILA's)
  - Backward torsions become asymmetric in extension and symmetric in flexion (ILA's)
- Normal lumbar adaptation
  - ROT in direction of deep sulcus, SB away

Sacral Torsions

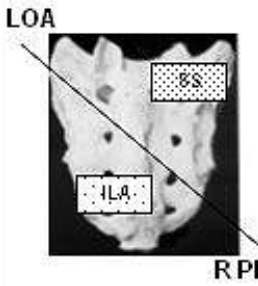
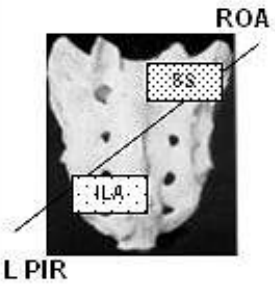
Sacral Torsion Dysfunctions

Deep (Anterior) ⬚ Shallow (Posterior/Inferior) ⬚

Diagnosis	RST on ROA	RST on LOA
Asymmetry of Position		
Sacral Sulcus (SS)	Left Deep	Left Deep
Inferior Lateral Angle (ILA)	Right Posterior & Inferior	Right Posterior & Inferior
Axis	Right Oblique	Left Oblique
Lumbar Lordosis	Increased	Decreased
Lumbar Scoliosis	Convex Left	Convex Left
L5 Position	Rotated Left	Rotated Left
Medial Malleolus in Prone Position	Right Short	Right Short
Backward Bend Test	Findings Diminish - Level	Findings Increase
Forward Bend Test	Asymmetry increases	Findings diminish - Level
Palpation		
Restricted Motion		
Gillet's Test (Stork Test)	Positive Left	Positive Right
Seated Flexion Test	Positive Left	Positive Right
Spring Test	Negative	Positive
Tissue Texture		
Hypertonus	Left piriformis	Right piriformis

Sacral Torsion Dysfunctions

Deep (Anterior) ⬚ Shallow (Posterior/Inferior) ⬚

Diagnosis	LST on LOA	LST on ROA
Asymmetry of Position		
Sacral Sulcus (SS)	Right Deep	Right Deep
Inferior Lateral Angle (ILA)	Left Posterior & Inferior	Left Posterior & Inferior
Axis	Left Oblique	Right Oblique
Lumbar Lordosis	Increased	Decreased
Lumbar Scoliosis	Convex Right	Convex Right
L5 Position	Rotated Right	Rotated Right
Medial Malleolus in Prone Position	Left Short	Left Short
Backward Bend Test	Findings Diminish - Level	Findings Increase
Forward Bend Test	Asymmetry increases	Findings diminish - Level
Palpation		
Restricted Motion		
Gillet's Test (Stork Test)	Positive Right	Positive Left
Seated Flexion Test	Positive Right	Positive Left
Spring Test	Negative	Positive
Tissue Texture		
Hypertonus	Right piriformis	Left piriformis

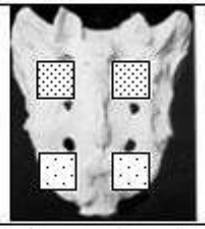
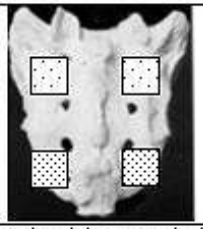
Bilateral Anterior Sacral Nutation

- Also known as bilaterally flexed sacrum or bilateral inferior sacral shear
- Forward rotation on MTA
  - Rare
- Jumping from a height and landing
- Symptoms:
  - Persistent lumbosacral and gluteal pain
  - Lumbosacral/gluteal pain worse with forward bending, walking, standing, down stairs
  - Prefers to lie prone
  - Stands with accentuated lordosis
  - Uncomfortable sitting
  - Lumbosacral flexion limited

Bilateral Posterior Sacral Nutation

- Also known as bilaterally extended sacrum or bilateral superior sacral shear
- Backward sacral rotation on MTA
- Lifting heavy load in midline position
- Symptoms:
  - Constant lumbosacral pain
  - Lumbosacral pain worse with backward bending, sit-to-stand, walking down stairs, patient prefers to sit slumped with arms on thighs, lie supine or fetal position, stands with flat back
  - Lumbosacral extension limited

Bilateral SI Dysfunctions

Bilateral Sacroiliac Dysfunctions Deep (Anterior) ⊡ Shallow (Posterior) ⊡		
Findings	**Bilateral Sacral Flexion**	**Bilateral Sacral Extension**
Asymmetry of position		
Sacral base	Anterior bilaterally	Posterior bilaterally
Sacral sulci	Deep bilaterally	Shallow bilaterally
ILAs	Posterior bilaterally	Anterior bilaterally
Medial malleoli (Prone)	Even	Even
Palpation		
Backward bending	No change in findings	Sacral sulci more shallow ILA's more anterior
Lumbar lordosis	Increased	Decreased (may be increased)
Restricted motion		
Seated flexion test	Positive bilaterally	Positive bilaterally
Standing flexion test	Positive bilaterally	Positive bilaterally
Gillet's or Stork test	Positive bilaterally	Positive bilaterally
Lumbosacral spring test	Negative	Positive
Resisted motion	Sacral extension	Sacral flexion
Tissue texture change		
Tension	Bilateral around sacral sulci	Bilateral around sacral sulci
Hypertonus	Piriformis, psoas	Pelvic floor, longissimus
Tenderness		
Palpation	Dorsal SI ligaments, Baer's point, ILA	Dorsal SI ligaments

Unilateral Anterior Sacral Nutation

- Also known as inferior sacral shear, unilateral flexed sacrum or side bent lesion
- Usually traumatic
  - Land on one leg with spine extended (volleyball/basketball) Superior transverse axis
- Associated with posterior innominate rotation and non-neutral L5 dysfunction (L innominate posterior rotation with L5 ERSL)
  - Treat L5 dysfunction first
- Less common than torsions 3:2, left flexion most common
- Symptoms
  - Pain usually in sacral and gluteal areas, unilateral
  - Ipsilateral sciatica
  - Gait problem, pain opposite side
  - Worse with standing (<20 min)
  - Relieved by sitting
- Tests for sacral sulci and ILA's definitive

Unilateral Posterior Sacral Nutation

- Also known as superior sacral shear or unilateral sacral extension
- Superior transverse axis
- Rare, most common on right
- May be associated with anterior innominate dysfunction
- May be confused with R on L torsion
- Caused by bending and twisting followed by forceful extension with load. Hypertonus of ipsilateral longissimus thoracis as result of thoracolumbar area strain
- Often treating source of hypertonus (TL junction) fixes problem
- Sometimes must treat L5 (FRSR)

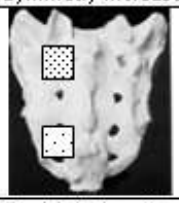
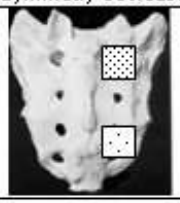
Unilateral Sacral Nutation Diagnosis

- Sulcus deep and ILA inferior/posterior on same side (anterior nutation)
- Flexed and extended positions
  - ILA's never become symmetric with unilateral nutations
- Seated flexion test
  - Positive on left with left anterior nutation
- Normal lumbar adaptation
  - ROT in direction of deep sulcus, SB away

Unilateral SI Dysfunctions

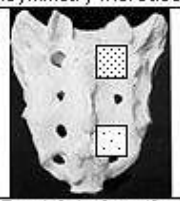
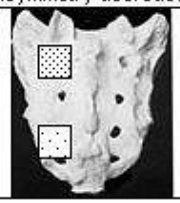
Unilateral Sacroiliac Nutation Dysfunctions

Deep (Anterior) ⊠ Shallow (Inferior/Posterior) ⊡

Findings	Unilateral Sacral Anterior Nutation Left	Unilateral Sacral Posterior Nutation Left
Asymmetry of position		
Sacral sulci	Deep on left	Shallow on left
ILA's	Inferior/posterior on left	Superior/Anterior on left
Medial malleoli (Prone)	Long left	Short left
L5 (Neutral)	TP posterior on left (Left rotated/right side bent)	TP posterior on right (Right rotated/Left side bent)
Lumbar curve	Left convexity	Right convexity
Lordosis	Normal to increased	Decreased
Backward bending test	Sacral sulci depths/ILA's more symmetrical	Asymmetry of sacral sulci and ILA's increased
Forward bending test	Asymmetry increased	Asymmetry decreased
Palpation		
Restricted motion		
Lumbar spring test	Negative	Positive
Inhalation	Restricted posterior motion of sacral base	Both sides of sacral base move posteriorly
Exhalation	Both sides of sacral base move anteriorly	Restricted anterior motion of sacral base
Stork test (Gillet's test)	Positive on left	Positive on left
Seated flexion test	Positive on left	Positive on left
Restricted sacral motion	Left sacral base cranial and posterior nutation	Left sacral base caudal and anterior nutation
Tissue texture		
Hypertonus	Left piriformis/psoas	Left longissimus
Tenderness		
Palpation	Left posterior SI ligaments & ILA	Left posterior SI ligaments & ILA

Unilateral Sacroiliac Nutation Dysfunctions

Deep (Anterior) ⊠ **Shallow (Inferior/Posterior)** ⊡

Findings	**Unilateral Sacral Anterior Nutation Right**	**Unilateral Sacral Posterior Nutation Right**
Asymmetry of position		
Sacral sulci	Deep on right	Shallow on right
ILA's	Inferior/posterior on right	Superior/Anterior on right
Medial malleoli (Prone)	Long right	Short right
L5 (Neutral)	TP posterior on right (Right rotated/left side bent)	TP posterior on left (Left rotated/right side bent)
Lumbar curve	Right convexity	Left convexity
Lordosis	Normal to increased	Decreased
Backward bending test	Sacral sulci depths/ILA's more symmetrical	Asymmetry of sacral sulci and ILA's increased
Forward bending test	Asymmetry increased	Asymmetry decreased
Palpation		
Restricted motion		
Lumbar spring test	Negative	Positive
Inhalation	Restricted posterior motion of sacral base	Both sides of sacral base move posteriorly
Exhalation	Both sides of sacral base move anteriorly	Restricted anterior motion of sacral base
Stork test (Gillet's test)	Positive on right	Positive on right
Seated flexion test	Positive on right	Positive on right
Restricted sacral motion	Right sacral base cranial and posterior nutation	Right sacral base caudal and anterior nutation
Tissue texture		
Hypertonus	Right piriformis/psoas	Right longissimus
Tenderness		
Palpation	Right posterior SI ligaments & ILA	Right posterior SI ligaments & ILA

Treatment

- Muscle energy
- Joint mobilization
- Joint manipulation
- Muscle stretching
- Trunk stabilization

Correction of Forward Sacral Torsion

- Lie axis side down
- Rotate trunk to right with right arm off table
- Flex knees and hips to localize forces at L/S junction
- Resist bottom heel lifting toward ceiling

ROR

Correction of Backward Sacral Torsion

- Lie axis side down
- Extend lower leg to induce some sacral flexion
- Flex upper hip so leg off table
- Extend trunk to L/S junction
- Rotate trunk left to L/S junction
- Resist lifting upper leg toward ceiling

LOR

Correction of Bilateral Anterior Nutated Sacrum

- Patient seated
- Feet apart and legs internally rotated
- Patient flexes forward
- ATC hands on sacral apex and thoracic spine
- Maintain pressure on sacral apex (ILA's) and resist trunk extension with full inhalation

Correction of Bilateral Posterior Nutated Sacrum

- Patient seated
- Feet together and legs externally rotated
- Arms crossed
- ATC hands on sacral base and across anterior chest
- Maintain pressure on sacral base and resist trunk flexion with full exhalation or have patient arch back by pushing abdomen to knees

Correction of Unilateral Anterior Sacral Nutation

- Patient prone
- Abduct (15°) and internally rotate left leg
- ATC's right hand on left ILA
- Apply and maintain anterior and superior pressure on left ILA as patient inhales and holds breath
- ATC maintains pressure as patient exhales

Left Unilateral Anterior Nutation

Correction of Unilateral Posterior Sacral Nutation

- Patient prone
- Abduct (15°) and externally rotate right leg
- Trunk extended via prone on elbow position
- ATC's right hand on right sacral base
- Apply and maintain anterior and inferior pressure with right hand as patient exhales
- ATC's left hand applies posterior pressure to right ASIS
- After exhalation, patient pulls ASIS toward table
- Return to prone lying position while maintaining pressure

Right Unilateral Posterior Sacral Nutation

Treatment Sequence

- Lumbar spine, pubes, innominate shears, sacroiliac dysfunction, iliosacral dysfunction, muscle imbalances (Greenman)
- Pubes, innominate shears, lumbar spine, sacroiliac dysfunction, iliosacral dysfunction (Issacs & Bookhout)
- Leg muscles, pubes, iliosacral (flares, innominate shears, rotations), sacroiliac, lumbar (unless L5, then before sacrum) (Rex)
- Pubes, iliosacral (rotations, innominate shears, flares) sacroiliac (Mitchell)

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