Transitional Lumbosacral Vertebrae

A Self Case Study

Mary Olsen
July 1, 2014
BASI CTTC
Chicago, IL
ABSTRACT

This paper presents research about Transitional Lumbosacral Vertebrae (TLSV), the pain and degenerative syndrome known as Bertolotti’s syndrome and the functional movement training the BASI Pilates method lends to managing it.
Anatomical Description

Lumbosacral Transitional Vertebrae

TLSV’s are congenital spinal anomalies defined as either sacralization of the lowest lumbar segment or lumbarization of the most superior sacral segment of the spine. The degree of morphologic variations of these segments was classified in 1984 by Castellvi and is shown in Figure 1. Of particular interest, the association of low back pain and TLSV subgroups demonstrates types II and IV are most commonly associated with low back pain.
Bertolotti’s Syndrome

Low back pain of this syndrome is thought to be of varying etiologies, arising from different locations 1) disk spinal canal above the transition 2) degeneration of the anomalous articulation between the TLSV and the sacrum 3) facet joint arthrosis contralateral to a unilateral or articulating TLSV and 4) extraforrninal stenosis secondary to the presence of a broadened transverse process. Hyper mobility and abnormal torque movements are believed to place the disk and facet joints at greater risk of accelerated degeneration. Other research shows the iliolumbar ligament (Figure 2) at the level immediately above the transitional vertebrae was thinner and weaker than it is in a normal specimen.
Discussion

The Core and the Lumbo/Pelvic Hip Complex

The core or “Powerhouse” as referred to by Joseph Pilates, is a construct of muscles and connective tissues of the lumbar spine, pelvic girdle and hip joint. The center of gravity of the individual and all movement of the body originate here. The muscles believed to be responsible and essential for spinal and pelvic stabilization are the Diaphragm, the TA, Internal Obliques, Erector Spinae group (particularly the Multifidus), and the pelvic floor group. Recruitment and activation of these muscles protects the spine by increasing intra-abdominal pressure and preventing excessive articulation of the vertebral segments during flexion, extension, rotation and excessive loading. Neutral Pelvis is critical to the influence of how these muscles fire in terms of structure and function. When these muscles fail to fire in tandem limb movement occurs before trunk stabilization leaving the already structurally impaired spine vulnerable to injury. With a condition such as TLSV and Bertolotti’s a great deal of the core stability is compromised structurally, and neuromuscularly. Although TLSV is a congenital abnormality, it is often not clinically recognized until after the second decade of life. It was identified in 1917 by Mario Bertolotti, an Italian surgeon, as having a possible relationship between low back pain and congenital anatomical abnormalities in the last lumbar vertebrae. In most research data to date an average of 4-10% of the population with chronic low back pain present with this syndrome. Since its first description dates from 1917
little is known about the biomechanical effects of such. It has been assumed that modifications in the spine can occur, generating abnormal weight overload or torque in the articular facets and adjacent vertebral discs resulting in degeneration.

Pilates work can greatly improve the mechanical imbalance of the condition TLSV for this reason alone but it is not the only principle of Pilates of great importance here. The principles are Awareness and achievement of correct alignment, Balance of pace, the connecting of Breath to conscious muscle recruitment, Concentration of the mind and body, Center of stability in neutral pelvis, Control of stabilizers in small movements, the Efficiency to coordinate the core, the Flow of movement, absolute Precision of the work for effectiveness, and Harmony of the Mind, Body and Spirit. The Ten Principles that have evolved from the teachings of Joseph Pilates and the BASI approach are fundamental to creating and achieving functional movement.
**Self Case Study**

**Name:** Mary

**Age:** 44

**Job:** Cosmetologist and BASI CTTC Student

In February of 2012 my initial evaluation was with primary complaints of chronic spinal pain and stiffness, pain radiating through the groin, hips, thighs, calves ankles and feet, particularly the right. Cervical pain and radiating right arm pain. These symptoms had been present at this level since 2004. At that time, all physical activity, standing and sitting for periods of 20 minutes created and magnified the pain until I remained relatively immobilized for the majority of the next 8 years and losing most ROM in both the left and right hips. My lumbar disk degeneration is significant with some cervical degeneration also. Moderate to severe carpal tunnel syndrome on the left and moderate on the right, surgery on the left was done in 2006. I had received regular and varying steroidal spinal and hip injections with approximately 25-30% pain relief for 8-10 weeks. We began a basic conditioning program; much of the fundamental BASI Reformer and Cadillac repertoire was included as well as myofascial release techniques. The early primary goal was to engage, strengthen and begin to stabilize the core, develop some hip disassociation and range of motion and develop scapular stabilization.
EXAM: MRI LUMBAR SPINE WITHOUT CONTRAST

HISTORY: Back pain and leg spasms.

TECHNIQUE: Multiplanar multisequence imaging of the lumbar spine was performed without contrast on a 1.5 Tesla magnet.

FINDINGS: There is subtle transitional lumbosacral anatomy. As the remainder of the spine was imaged on the same day, vertebral body counting will be performed from C2 inferior. The last large complete disc space is L4-5 which is also the level of greatest angulation. There is, therefore, a somewhat hypoplastic L5-S1 disc as well as partial sacralization of L5.

The conus medullaris is unremarkable. Vertebral body heights are well-maintained with no compression fracture, focal subluxation, or suspicious marrow signal.

There is multilevel degenerative disc disease, moderate and most prominent at L4-5.

L1-2: Mild facet arthropathy. No protrusion or spinal stenosis.

L2-3: Mild disc bulging. There is a small superimposed left posterolateral disc protrusion indenting the thecal sac in the region of the intrathecal left L3 nerve root (series 8 image 31). Mild central canal narrowing. Mild facet arthropathy contributes to mild bilateral foraminal narrowing.

L3-4: Mild disc bulging and facet arthropathy mildly narrow the neural foramina. No central stenosis.

L4-5: Mild disc bulging/endplate spurring and mild facet arthropathy mildly to moderately narrow the neural foramina. No central stenosis.

L5-S1: The disc is hypoplastic. There is mild left-sided disc bulging/endplate spurring with a small annular tear. Mild left foraminal narrowing. No central or right foraminal stenosis.

IMPRESSION:
1. Transitional lumbosacral anatomy as above. If a procedure is ever performed, recommend correlation with plain radiographs to ensure correct level.
2. Multilevel lumbar spondylosis as above including a small left posterolateral L2-3 disc protrusion. There is no high-grade spinal stenosis.

MJE:jlh
Signed on 02/20/11 08:59 PM By Matthew J. Evon
EXAM: MRI LUMBAR SPINE WITHOUT CONTRAST

HISTORY: Back pain and leg spasms.

TECHNIQUE: Multiplanar multisequence imaging of the lumbar spine was performed without contrast on a 1.5 Tesla magnet.

FINDINGS: There is subtle transitional lumbosacral anatomy. As the remainder of the spine was imaged on the same day, vertebral body counting will be performed from C2 inferior. The last large complete disc space is L4-5 which is also the level of greatest angulation. There is, therefore, a somewhat hypoplastic L5-S1 disc as well as partial sacralization of L5.

The conus medullaris is unremarkable. Vertebral body heights are well-maintained with no compression fracture, focal subluxation, or suspicious marrow signal.

There is multilevel degenerative disc disease, moderate and most prominent at L4-5.

L1-2: Mild facet arthropathy. No protrusion or spinal stenosis.

L2-3: Mild disc bulging. There is a small superimposed left posterolateral disc protrusion indenting the thecal sac in the region of the intrathecal left L3 nerve root (series 8 image 31). Mild central canal narrowing. Mild facet arthropathy contributes to mild bilateral foraminal narrowing.

L3-4: Mild disc bulging and facet arthropathy mildly narrow the neural foramina. No central stenosis.

L4-5: Mild disc bulging/endplate spurring and mild facet arthropathy mildly to moderately narrow the neural foramina. No central stenosis.

L5-S1: The disc is hypoplastic. There is mild left-sided disc bulging/endplate spurring with a small annular tear. Mild left foraminal narrowing. No central or right foraminal stenosis.

IMPRESSION:
1. Transitional lumbosacral anatomy as above. If a procedure is ever performed, recommend correlation with plain radiographs to ensure correct level.
2. Multilevel lumbar spondylosis as above including a small left posterolateral L2-3 disc protrusion. There is no high-grade spinal stenosis.

MJE: Jlh
Signed on 02/20/11 08:59 PM By Matthew J. Even
**Conditioning Program**

*indicates beginning program

All others are included in current conditioning

**Warm Ups - Mat**

*Supine shoulder flexion and extension 7-10 repetitions
*Supine Scapular protraction and retraction 7-10 repetitions
*Supine chest openings 7-10 repetitions
Supine Spine Twist 7-10 repetitions
Leg Lifts/Changes 7-10 repetitions
Pelvic curl 7-10 repetitions

**Foot Work** – *Reformer and/or Cadillac* - given the pathologic changes to the lumbar discs these exercises vary based on daily compensations; it allows me to identify any compensation taking place in my left hip and tissue restriction on my right.

*Parallel Heels
*Parallel Toes
*V Position Toes
*Open V Heels
*Open V Toes
Calf Raises
Prances
Prehensile

**Abdominals - Reformer, Mat, Step Barrel, Cadillac**

All abdominal work is done in a supported manner and I adhere to the sufficient overload principle while being mindful of complete abdominal recruitment.

Reformer

*Hundred Prep
*Hundred
Coordination
Flat Back

Mat

*Hundred prep
*Chest Lift
Chest Lift with Rotation
*Hundred
Criss Cross
Hamstring Pull
Coordination

Step Barrel
Chest Lift
Reach
Overhead Stretch
Teaser Prep

Cadillac

Abdominals - Warm Up Series
  * Roll Up with RU Bar
  * Mini Roll-Ups
  * Mini Roll-Ups Oblique

Cadillac

Abdominals
  Breathing with Push Through Bar
  Bottom Lift with Roll Up Bar

**Hip Work – Reformer – Avalon Step Barrel – Cadillac**

The progressive and independent resistance of springs is optimal for muscle imbalance and fascia restrictions.

Reformer
  * Frog
  * Circles (Up, Down)
  * Openings
  * Extended Frog
  * Extended Frog Reverse

Avalon Step Barrel
  Frog
  Openings
  Scissors
  Helicopter

Cadillac
  Frog
  Circles (Down, Up)
  Bicycles
  Single Leg Supine
  Frog
  Circles (Down, Up)
  Hip Extension

**Spinal Articulation – Cadillac – Reformer**

All spinal articulation to date is done in closed chain for the purpose of safety of the lumbar.

Cadillac
  Monkey Original
  Tower Prep
  Tower

Reformer
  Bottom Lift with Extensions
  Short Spine
  Long Spine
Stretches- Reformer-Cadillac-Pole Series-Mat
Mat
  *Piriformis Stretch
  *Runners Stretch
  *Rest Position
Reformer
  *Standing Lunge
  *Side Split
Cadillac
  Shoulder Stretch
Pole Series
  *Shoulder Stretch
  *Overhead Stretch
  *Side Stretch
  *Spine Twist

Full Body Integration – Mat-Cadillac-Reformer spinal flexion is limited.
Mat-Bridging
  Leg Pull Front
  Leg Pull Back
Cadillac
  Thigh Stretch with Roll Up Bar
  Kneeling Cat Stretch
Reformer
  Scooter
  Round Back
  Flat Back
Up Stretch Series
  Up Stretch 1
  Elephant
  Up Stretch 2
  Long Stretch

Arm Work – Reformer-Cadillac Arm work is chosen bearing in mind engaging the serratus for scapular stabilization and keeping the upper trapezius from being hypertonic. Modified as needed.
Reformer
Arms Supine Series
  *Extension
  *Adduction
  *Up Circles
  *Down Circles
  *Triceps
  *Shoulder Push
Arms Sitting Series
  Chest Expansion
  Biceps
  Rhomboids
  Hug-a-Tree
  Salute
Cadillac
  Arms Standing Series
  Chest Expansion
  Hug-a-Tree
  Circles (Up and Down)
  Punches
  Butterfly
Push Thru Series
  Shoulder Adduction Single Arm
  Shoulder Adduction Double Arm
  Sitting Side Prep
  Sitting Side

Leg Work – Mat-Cadillac-Reformer
Gluteals Side Lying Series
  *Forward and Lift
  *Forward with Drops
  *Gluteals Kneeling Series
  *Hip Extension Bent Knee
  *Hip Abduction Bent Knee
  *Hip Extension Straight Leg
  *Adductor Lift

Reformer
  *Single Leg Skating
  Long Box Series
  Hamstring Curl
Cadillac
  Squats
Single Leg Side Series
  Changes
  Circles (Forward and Back)

Lateral Flexion/Rotation-Reformer-Mat as my condition improves more lateral flexion and rotation will be added.
Mat
  *Side Lifts
Reformer
  *Mermaid
Short Box Series
*Side Over on Box

**Back Extension - Mat-Cadillac-Reformer** All back extension is done with caution as the QL easily becomes hypertonic above the TLSV.

**Mat**
*Back Extension*  
*Double Leg Kick*  
*Swimming*  
*Rocking Prep*

**Cadillac**  
*Push Through Series*  
*Prone1*  
*Hanging Back*

**Reformer**  
*Long Box Series*  
*Pulling Straps 1*  
*Pulling Straps 2*

**Notes:** I have compiled a large selection of the repertoire I use with consideration for my daily condition. I will also note manual and neuromuscular therapy during this time was the only other intervention used to achieve these results. My primary goals are stabilization and mobilization. The Warm-Up is almost always the same for my daily routines. I must limit flexion and rotation in large part however, on my best days I include them while being very mindful of any excessive movement of the lumbar spine. I have to re-educate the hip extensors and hamstrings daily due to the articulating surface at the sacrum creating a compensatory pattern. Also on a daily basis I must check my internal rotation of my left leg and select movements accordingly. This foundation served to restore a great deal of functionality to my daily life. In 2 years, the muscle imbalance, tissue restriction and pain cycle I had been limited by have greatly improved and continue to improve on a daily basis still. As part of my continued effort to release restrictions and develop more efficient and effective patterns I will be working with Joanne Macza PT of Body Gears in Chicago IL. in conjunction with private
training sessions with Cindy Reid of Flow Studios. Joanne specializes in functional manual therapy and I am excited and looking forward to the progress we will make.

**Conclusion**

The human body is a fascinating, living, breathing, adaptable organism. Abnormalities, anomalies, malformations and deformities clearly, in many cases cannot and does not prevent the human body from living on. It is our job to find ways to optimize its ability to function whenever we can and to assist in the recovery of injury or damage. The Pilates approach to functionality on all levels is a body of work very similar to that of the human body itself; it is, in its essence a living, breathing, adaptable organism. The repertoire is brilliant in its ability to be adapted to any challenge. I am most grateful to Joseph Pilates and his many students generation after generation that has preserved and studied his teaching.
Bibliography

Arquivos de Neuro-Psiquiatria

Print version ISSN 0004-282X

Arq. Neuro-Psiquiatria. vol.67 no.2a São Paulo June 2009

http://dx.doi.org/10.1590/S0004-282X2009000200018

http://radiopaedia.org/articles/castellvi-classification-of-lumbosacral-transitional-vertebrae

American Journal of Radiology http://www.ajnr.org/content/31/10/1778.full

The Bone and Joint Journal http://www.bjj.boneandjoint.org.uk/content/87-B/5/687.short


Published online Jul 23, 2010. doi: 10.1016/j.clinbiomech.2010.06.018

PMCID: PMC2949466

NIHMSID: NIHMS225315

Body Arts and Science International. Study Guide: Comprehensive Course 2000-2013


Body Arts and Science International. Wunda Chair and Ladder Barrel Movement Analysis Workbook 2000-2012


Assessment and treatment of muscle imbalance : The Janda Approach / Phil Page, Flare Frank, Robert Lardner 2010