Spondylolysis and Spondylolisthesis: A Holistic Approach to Healing

Roxanne Riley
October 1st, 2018
Santa Cruz, CA 2017 & Portland, OR 2018
Abstract

Pilates can help to holistically heal many conditions and injuries that occur in the human body by strengthening the core, back and correcting faulty posture. This case study explores a case of Spondylolysis in a young, fit and active gymnast, Rachel James. Spondylolysis occurs when overextension and flexion of the lumbar spine causes a small portion of the vertebra, the pars interarticularis, to fracture or crack. This fracture causes lower lumbar pain and muscle tightness and if not treated properly can develop into a much more severe condition, Spondylolisthesis. In Spondylolisthesis, one vertebra starts to anteriorly slip against the vertebra below it. To avoid her Spondylolysis from progressing to Spondylolisthesis, Rachel will practice Pilates two times a week for ten weeks. Her training program will incorporate exercises that encourage strengthening of both the transverse and rectus abdominis, opening of the shoulders, strengthening of the back extensors, and aim to correct her overall posture. By taking this holistic approach, we hope to aid in healing Rachel's Spondylolysis and avoid the advancement to Spondylolisthesis.
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Spondylolysis and Spondylolisthesis occur in the lumbar spine (right). Spondylolysis develops through a crack or stress fracture in the pars interarticularis, which is a small, thin portion of the vertebra that connects the upper and lower facet joints. If not treated properly, the condition can worsen to Spondylolisthesis ("Spondylolysis and Spondylolisthesis.").

In Spondylolisthesis, the pars interarticularis separates and the vertebra shifts forward onto the disk below it. There are four grades of disk slippage. ("Spondylolysis and Spondylolisthesis.").
Introduction

The spine of the human body is very complex and can experience many different injuries and conditions, particularly, the lumbar spine. The lumbar spine makes up the vertebral column of L1-L5. An estimated 80% of adults experience low back pain at some point in their lifetime (Davis). Worldwide, back pain is the leading cause of disability and costs Americans approximately 50 billion dollars a year in healthcare expenses ("Back Pain Facts and Statistics"). Frequently, low back injuries and conditions are worsened by weak or inhibited abdominals, spinal flexors and extensors, and the effects of bad posture over time.

The lumbar spine is an interconnected network of spinal muscle, bones, tendons, nerves and discs. It consists of five vertebrae labeled L1-L5. The lower the vertebra is in the spinal column, the more weight it must bear. The L1-L5 vertebra are the biggest unfused vertebrae in the spinal column which enable them to support the weight of the entire torso. Each vertebra stacks on top of each other with an intervertebral disc between them which acts as a shock absorber to protect the vertebra. Because the lower vertebrae (L4 and L5) bear the most weight, they are most prone to strain and injury ("Spondylolysis and Spondylolisthesis.").

Spondylolysis is a stress fracture or crack in the pars interarticularis, which is the segment of bone that connects the facet joints in the back of the spine. The fracture can be caused by overuse or genetics. Overuse can occur from frequent overstretching of the lumbar spine, and may occur in younger athletes including gymnasts, weight lifters and football players. Some individuals are genetically born with thinner vertebral bones that are more vulnerable to fractures, which causes the fracture ("Spondylolysis and
Once Spondylolysis occurs, it can develop into Spondylolisthesis over time if not properly addressed. Spondylolisthesis is more severe and develops when the weakened vertebra slips on the one below it after the pars interarticularis detaches at the stress fracture. This occurs in 25% of Spondylolysis cases (Ulrich). Most of the weight of the body is carried and absorbed in the lumbar spine, therefore when the body moves in everyday actions excessive stress is put on this area raising the possibility of further disc slippage (Highsmith).

Treatment of Spondylolysis, in the prevention of the injury advancing to Spondylolisthesis, can be done holistically through a regular Pilates practice. This will strengthen the abdominal muscles, including the transverse abdominis and multifidus, and promote better posture of the spine. Correcting bad posture can reduce the pressure and weight on the lumbar vertebra. Posture may greatly affect the whole body and often becomes so habitual over time that it can cause great damage to our spines. Poor posture while sitting at desks and in cars may encourages the body to slump forward, stressing on the lower muscles and discs of the back. Sitting frequently and for long periods of time can also result in tight hip flexors while potentially restricting blood flow to the gluteus maximus and medius. Prolonged daily sitting can cause tightness in the neck and back, increasing conditions and injuries to the spine (Malanga).

Regular strengthening and stretching of the abdominal and low back muscles and stretching of the hip flexors and spinal extensors are non-invasive remedies for Spondylolysis. By using a holistic exercise program, the progression to Spondylolisthesis can be avoided and the pain can be minimized.
Case Study

This study focuses on Rachel James (RJ), an 18 year old gymnast. RJ is very fit and active; she has been doing gymnastics since the age of 3 and is now a member of her university's gymnastics team. Over time, the repetitive flexion and extension of the lumbar vertebra and the high impact of tumbling has led her to develop Spondylolysis of the L4 vertebra. Upon her diagnosis, her physician prescribed physical therapy to treat and heal the fracture. RJ limited her gymnastics movement and completed six weeks of physical therapy (PT). The PT greatly reduced the pain and increased her mobility but because she continues to practice gymnastics almost daily, she must continue to focus on abdominal strengthening to avoid the injury progressing to Spondylolisthesis. RJ still experiences low back pain and it increases when she is practicing her routines. With gymnastics team practice increasing in intensity and college classes beginning soon, where she will often be sitting both in class and to study, RJ does not want to lose the progress she gained from her PT program and will begin a regular Pilates practice.

In RJ’s first Pilates session I assessed her posture in her initial Roll Down. RJ appears to be quadricep complex and hip flexor dominant in her movements and this is observed in her gait. She walks with quick short steps, indicating tightness in her hip flexors. She also has tight hamstrings and anteriorly tilts her pelvis while standing up right, indicating hyperlordosis. I began her warm up with pelvic curls and she feels pain in her lumbar spine if she does not actively recruit her lower abdomen and emphasize a posterior tilt throughout the movement. In supine spine twist I have to cue her to bias towards an imprint of her low back into the mat because she begins to overly emphasize an anterior tilt of her pelvis when her legs are in the tabletop position,
decreasing her abdominal recruitment. During chest lift, I can see that it is even more for difficult for RJ to stabilize her pelvis in neutral as evidenced by gripping in her hip flexors versus recruiting her lower belly. After a few repetitions of chest lift RJ begins to let her back arch into an anterior tilt and she begins to recruit her mid-back versus her transverse abdominis. RJ loses her TA engagement between chest lift repetitions and lets her ribs flare as she lowers her chest to the mat. She is able to keep better pelvic stability in chest lift with rotation but grips in her neck extensors versus leaving her head heavy in her hands while allowing her shoulders to internally rotate.

After assessing RJ, I have concluded that her Pilates program should be tailored to the following needs:

- Recruit lower abdominals to stabilize her pelvis in neutral position
- Strengthen transverse abdominis to keep ribs knit down
- Co-contraction of abdominals and back extensors
- Stretch hamstrings and hip flexors to relieve tension in low back
- Release tension in chest by opening up shoulders
- Strengthen upper back extensors and shoulder girdle to encourage external shoulder rotation when standing and sitting
- Focus on lateral breathing to strengthen core and mobilize the rib cage
- Encourage better overall posture when standing and sitting
RJ’s Pilates Program

Sessions 1-10

Warm Up
- Roll Down, Spine Twist Supine, Chest Lift, Chest Lift with Rotation
- **Desired Results:** Understand fundamentals of breath and abdominal recruitment to stabilize the pelvis in neutral

Footwork
- Chair: Parallel Heels, Parallel Toes, V-Position Toes, Open V-Heels, Open V-Toes, Calf Raises, Single Leg Heels, Single Leg Toes
- **Desired Results:** Warm up, maintain pelvic stability, recruit hamstrings

Abdominal Work
- Chair: Standing Pike, Standing Pike Reverse, Pike Sitting, Cat Stretch Kneeling
- **Desired Results:** Engage lower abdominals with lumbar and thoracic flexion, stretch low back, engage back extensors

Hip Work
- Chair: Hip Opener
- Reformer: Frog, Circles Down, Circles Up, Openings
- **Desired Results:** Open up hips by promoting hip dissociation and maintain pelvic stability, recruit hamstrings

Spinal Articulation
- Reformer: Bottom Lift with Extension
- **Desired Results:** maintain posterior tilt by recruiting lower abdominals, stretch hip extensors, shoulder opening

Stretch
- Reformer: Kneeling Lunge
- **Desired Results:** Stretch hip flexors while maintaining posterior tilt of pelvis, stretch out hamstrings maintaining neutral pelvis

Full Body Integration 1
- Reformer: Reverse Knee Stretch
- **Desired Results:** recruit abdominals in flexion and avoid hip flexor recruitment, disassociation of hips

Leg Work
- Reformer: Single Leg Skating
- **Desired Results:** Recruit glutes, maintain pelvic stability, and balance of supporting leg

Full Body Integration 2
- Reformer: Balance Control Back Prep
- **Desired Results:** pelvic stabilization, scapula stabilization

Arm Work
- Reformer: Supine Arm Series: Extension, Adduction, Circles Up, Circles Down, Triceps
- **Desired Results:** engage lower abdominals to stabilize pelvis throughout, arm and shoulder strength

Lateral Flexion/Rotation
- Reformer: Mermaid
- **Desired Results:** shoulder stability, stretch

Back Extension
- Mat: Back Extension on Mat, Kneeling Cat Stretch, Rest Position
- **Desired Results:** engage upper back extensors, keep low belly engaged to avoid pressure in the lower back
Sessions 5-10

Warm Up
- Roll down, Roll Up, Double Leg Stretch, Double Leg Stretch, Criss-Cross
- Desired Results: emphasize posterior tilt in roll up, maintain neutral in double, single and criss cross

Footwork
- Reformer: Parallel Heels, Parallel Toes, V-Position Toes, Open V-Heels, Open V-Toes, Calf Raises, Single Leg heels, Single Leg Toes
- Desired Results: Warm up, maintain pelvic stability, recruit hamstrings

Abdominal Work
- Reformer: Short Box Series—Round Back, Flat Back, Tilt, Twist, Round-about
- Desired Results: engage lower abdominals to hold pelvis in neutral or posterior tilt, strengthen back extensors

Hip Work
- Cadillac: Frog, Circles Down, Circles Up, Walking, Bicycle
- Desired Results: Open up hips by promoting hip dissociation and maintain pelvic stability, recruit hamstrings

Spinal Articulation
- Monkey
- Desired Results: Spinal Articulation, lower abdominal engagement versus gripping in hip flexors

Stretch
- Ladder Barrel: Gluteals, Hamstrings, Adductors, Hip Flexors
- Desired Results: Stretch out glutes, hamstrings, adductors and hip flexors

Full Body Integration 1
- Reformer: Upstretch 1 and 2
- Desired Results: scapula stability, lower abdominal engagement, lateral breathing

Leg Work
- Reformer: Hamstring Curl
- Desired Results: engage hamstrings, engage lower abdominals and upper back extensors to avoid pressure in the low back

Full Body Integration 2
- Balance Control Back
- Desired Results: Pelvic stabilization, abdominal engagement to allow hinging of hips, shoulder stability

Arm Work
- Arms Kneeling Series: Chest Expansion, Circles Up, Circles Down, Biceps, Triceps
- Desired Results: strengthen arms, stabilize scapula, maintain pelvic stability by engaging abdominals

Lateral Flexion/Rotation
- Chair: Side Bend
- Desired Results: stretch lateral flexors, oblique control, pelvic stability

Back Extension
- Chair: Swan
- Desired Results: engage upper back extensors, engage lower abdominals to avoid pressure in low back, maintain scapular stabilization
Conclusion

A regular Pilates practice is a holistic way to healing injuries. Low back pain is common in many people for many different reasons. If the proper Pilates training program is implemented these injuries can begin to heal, resulting in decreased pain. In cases of Spondylolysis, a training program should focus on strengthening the transverse and rectus abdominis, opening up the hips, strengthening the back extensors and opening the shoulders. These focuses will help to correct overall posture and promote a healthy spine, so that Rachel James can continue on with her passion for gymnastics, pain free.

After the first five weeks of training, RJ is already experiencing less pain in her low back. She has learned how to engage her lower abdominals verus gripping in her low back and hip flexors when in spinal flexion. Her upper back extensors are stronger and shoulders are becoming more externally rotated. This is helping improve RJ’s posture and is decreasing pressure and tightness in her lumbar spine. She is learning how to implement these practices in her gymnastics routine which is evident in her tumbling. RJ will continue to do Pilates two times a week and work towards the goals we have set.

Rachel’s case exemplifies how Pilates can help to non-invasively heal injuries by strengthening and stretching the body to correct posture and aid in living a life free of lower back pain. As Joseph Pilates once said, “If your spine is inflexibly stiff at 30, you are old. If it is completely flexible at 60, you are young.” (Pilates, Miller).
Bibliography


