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The Effect Of A Stability And Strengthening Program On The Oswestry Disability Index In A 14-Year-Old Patient With Spondylolisthesis: A Case Report

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University of New England

Department of Physical Therapy

PTH 608/708: Case Report Template

Name: Hormoz Maragoul - Title: Maragoul, The Effect of a Stability and Strengthening Program on the Oswestry Disability Index in a 14-year-old Patient with Spondylolisthesis: A Case Report.

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All responses should be in black text, 12-font, Times New Roman, and double-spaced with proper grammar and punctuation. Track changes must be switched OFF. Any assignments submitted in unacceptable condition as determined by the faculty will be returned to the student for resubmission in three days for a maximum score of 80%.

All case reports are written in *past tense*, so ensure that your submissions are past tense. No patient initials are necessary; please refer to your subject as "patient" throughout the manuscript.

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The Effect of a Stability and Strengthening Program on the Oswestry Disability Index in a 14-year-old Patient with Spondylolisthesis: A Case Report.

Hormoz Maragoul, SPT

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The patient signed an informed consent allowing the use of medical information for this report and was informed of the policies regarding the Health Insurance Portability and Accountability Act

The author acknowledges Michael Fillyaw for assistance with case report organization as well as Laura Roach for assistance with the patient's care during the clinical practicum

Abstract

Background and Purpose. Spondylolisthesis is a condition that describes the anterior translation of the cephalad vertebral segment of the skeletal spine relative to the caudal segment. This condition comes about by forces of gravity acting through the lordotic curve of the lumbar spine. Repetitive extension movements and weakened stabilizing muscles of the trunk like the abdominals and the gluteals may also play a role in contributing to spondylolisthesis. There is an increase in incidence rate of spondylolisthesis in adolescents who participate in sports involving repetitive extension motions. The purpose of this study is to examine the effectiveness of physical therapy management aimed at stability and strengthening for an adolescent with spondylolisthesis.

Case Description. The patient was a 14-year-old female who was referred to an outpatient orthopedic physical therapy clinic diagnosed with spondylolisthesis at the level of L5 with imaging. Upon evaluation, the patient demonstrated hyperflexibility, joint hypomobility, weakness and instability. Treatments included gluteals and abdominal strengthening and stabilization. The Oswestry Disability Index (ODI) was used to quantify impairment and to measure improvement over the episode of care.

Outcomes. During the initial evaluation, the patient reported a Numeric Pain Rating Scale (NPRS) of 6/10 at worse, an ODI score of 62% and a Manual Muscle Testing (MMT) grade of 2/5, 3/5 and 3/5 for transverse abdominus, hip extension and hip abduction, respectively. At the four-week point the patient reported a NPRS of 4/10 at worse, an ODI score of 20% and a MMT of 2+/5 for transverse abdominus with no change for hip extension and hip abduction. Results improved further during discharge with a reported 2/10 on the NPRS, a 7% on the ODI and MMT improvements to 3/5, 4/5 and 4/5 for transverse abdominus, hip extension and hip abduction, respectively.

Discussion. Abdominal stabilization and gluteal strengthening seem to have a positive effect in reducing both pain and ODI score of a fourteen-year-old dancer with low back pain caused by spondylolisthesis.

3053 Words

Background and Purpose

Spondylolisthesis is a condition that describes the anterior translation of the cephalad vertebral segment of the skeletal spine relative to the caudal segment. This condition comes about by forces of gravity acting through the lordotic curve of the lumbar spine. These forces may also consist of contractions of the posteriorly located erector spinae or the anteriorly located psoas muscle group. Repetitive extension movements and weakened stabilizing muscles of the trunk like the abdominals and the gluteals may also play a role in contributing to spondylolisthesis. The lumbosacral segment is the most commonly affected with symptoms possibly appearing as pain that is radicular or central.[1]

Developing spondylolisthesis is rare after the end of spinal growth and into adulthood.[2] At the age of eighteen, there is a six to seven percent incidence rate for development of spondylolisthesis and during adolescence, those who participate in active sports involving repetitive extension activities such as dance and gymnastics have an increased incidence rate.[2]

Classification of spondylolisthesis is important for measuring improvements made by the patient as well as a guideline for precautions and progressions. Meyerding's grading system uses five grades to describe the percent of anterior slippage: Grade I is 0-25%, grade II is 25-50%, grade III is 50-75%, grade IV is 75-100% and grade VI is greater than 100%.[3] Treatment effectiveness is measured both radiographically and symptomatically. The Oswestry Disability Index (ODI) is a reliable tool for determining the improvement during or after a plan of care and is often used to determine the severity of low back pain on effect on function.[4,5]

Treatment for spondylolisthesis is dependent on the patient's age, years of remaining growth, severity and degree of vertebral displacement. Conservative treatment usually involves rest and physical therapy, while surgical treatment involves direct repair of the displaced

vertebrae. Physical therapy interventions are aimed at reducing extension stresses in the lumbar spine by relieving tightness of the hip flexors and erector spinae and strengthening the abdominal muscles.[2] Stabilization exercises are often selected as the intervention of choice for patients who present with instability. Hicks et al[6] looked at many aspects such as strength and mobility and concluded that four variables were indicative of success with stabilization exercises: positive prone segmental instability test, aberrant movements, average straight leg raise (SLR) greater than 91 degrees, and age less than 40 years old. The study stated that having three or more of these signs is a good indicator of success with stabilization exercises with patients who present with low back pain.[6] The purpose of this case study is to assess the effectiveness of a stability and strengthening program in an adolescent patient with low back pain secondary to spondylolisthesis as measured by the ODI.

Patient History and Systems Review

The patient was a 14-year-old female who presented to an outpatient orthopedic clinic with a referral from an orthopedist and primary care physician with a diagnosis of low back pain secondary to spondylolisthesis. The patient had received a prior episode of physical therapy for her current condition but was discontinued due to a rest recommendation by her orthopedist. Upon evaluation, the patient presented with signs and symptoms consistent with spondylolisthesis and her primary complaints were low back pain localized in the lumbar spine with occasional radiating symptoms in bilateral gluteals and upper quadriceps. The patient reported varying levels of pain intensity that exacerbated with lumbar extension motions and ameliorated with rest. X-ray and magnetic resonance imaging (MRI) taken two-months prior to attending physical therapy confirmed a stress fracture of the pars interarticularis of L5 segment. Past medical history as cited from her medical chart provided by her pediatrician included

constipation, anger behavioral concern, knee strain, slipped patella, seizures during infancy, bilateral bunions and moderate intermittent asthma. The doctor indicated that the mechanism of injury likely included repetitive extension motions during dance and jazz programs. Comorbidities included asthma, depression, allergies, headaches and epilepsy. Since the patient was a minor, consent for the case study was requested and granted by both parent and patient. Patient and guardian agreed that the goal for physical therapy was to return to dance.

The patient's self-rating of overall health was good and both her mother and herself reported an excellent quality of life. The patient's cardiopulmonary and integumentary systems were unremarkable with communication and cognition unimpaired. The patient's neuromuscular system was deemed impaired due to the initial reports of radiating symptoms from the patient, even as no signs were present during evaluation. The patient also presented with hip weakness, anterior pelvic tilt, forward head and rounded shoulders posture. Table 1 summarizes the results of the systems review.

Clinical Impression 1

The patient was referred to physical therapy with a medical diagnosis of spondylolisthesis which was confirmed through imaging. Upon evaluation, she presented with low back pain and signs and symptoms consistent with the referring diagnosis. However, to be considered are juvenile arthritic changes, disc pathology, muscular pathology, neural tension, or sacroiliac pathology. The goal for the initial evaluation was aimed at confirming spondylolisthesis and ruling out differential diagnoses. The tests and measures used during the initial evaluation included manual muscle testing (MMT) for abduction, extension and transverse abdominus, posterior to anterior (P-A) mobilizations of lumbar segments centrally and unilaterally, observation, palpation, active lumbar range of motion, and sacroiliac special tests. Because

imaging and clinical tests and measures have demonstrated consistency, spondylolisthesis may be considered a likely diagnosis. With the high incidence rate of spondylolisthesis in adolescent athletes,[2] this patient was a good subject for a case report for because stability and strength in young patients is an important consideration for the longevity of their participation in physical activity as they transition into adulthood.

Examination – Tests and Measures

The patient completed an ODI and a numeric pain rating scale (NPRS) for pain severity. The ODI is a subjective outcome measure used to determine the effect of low back pain on the ability to perform functional activities with a sensitivity of 88% and a specificity of 85% .[4] The NPRS quantifies the severity of pain on a scale of one to ten. The patient reported the best and the worst pain levels experienced during everyday activities. MMT is a form of measurement that generates a quantitative value from a qualitative test of strength of individual muscles[7] and was used to identify specific muscles of weakness. The gluteus medius, gluteus maximus and transverse abdominus were specifically chosen as the primary area of focus due to their importance in lumbar stabilization. Joint mobility assessment was used to gain a better insight on the increased amount of range of motion noted during active range of motion observation. Joint mobility assessment measured the motion within a joint based on the direction of desired movement. This patient demonstrated hypermobility into extension and rotation. Standardized tests and measures were used during the initial evaluation and have been summarized in Table 2. Many of the tests and measures do not have strong psychometric properties to support use but have been used regularly in the physical therapy field in order to gain an objective understanding of the patient's impairments.

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241 **Clinical Impression 2**

242 Based on imaging, clinical tests, mechanism of injury and patient report, the patient
243 presentation was consistent with the diagnosis of spondylolisthesis. Joint hypermobility,
244 instability, hip and abdominal weakness, and mechanism of injury all confirm the initial clinical
245 impression. The patient remained a good candidate for this case report due to the strong evidence
246 in favor of the diagnosis and the importance of correction and maintenance of spondylolisthesis
247 in the young active population. The physical therapy diagnosis was low back pain and the
248 medical diagnosis was spondylolisthesis with an ICD-10 code of M54.5.[8]

249 A good prognosis was expected with a reduction in pain symptoms and reported
250 improvement with impairments. This patient's adherence to her orthopedist's recommendation to
251 avoid dance, jazz or gymnastics to prevent lumbar extension motions also contributed to her
252 good prognosis. Since spondylolisthesis is a fracture of the pars interarticularis, time was
253 required to achieve bone healing.[9,10] Adherence to the stabilization program was equally
254 important for improving recovery time, maintaining improvement and preventing sequalae.[6] The
255 patient required education to understand the importance of adherence to her home exercise
256 program. Review of her physician's notes were considered in directing the plan of care and avoid
257 adverse effects. As the patient progressed through the plan of care, a re-evaluation of strength
258 and control were performed to assess the effectiveness of the program from reported symptoms.
259 Follow up imaging by the physician was performed to insure fracture healing. MMT of the
260 glutes and transverse abdominus control were done after four visits and upon discharge. ODI
261 assessment was re-administered during discharge to evaluate the effectiveness of the treatment
262 on subjective and objective measures and compared with imaging results.

263 The focus of the plan of care was stabilization of the lumbar spine by strengthening weak

musculature that is responsible for supporting the low back and activating muscles that may have been underutilized. The focus of strengthening was on the gluteus medias and maximus. The focus of muscle activation was transverse abdominus control and functional movement correction. Patient goals are highlighted in Table 3.

Interventions

The patient was seen in the outpatient physical therapy clinic twice a week for an initial two-week period with two follow-up visits a month later. Each session lasted forty-five minutes and began with a ten-minute warm-up on a recumbent bicycle. Coordination of interventions with other personnel during clinic visits was not required as the patient was treated by the same physical therapy student from initial evaluation to discharge. Progressions were made to interventions after patient performance indicated good form and control with proper technique. Instructions were provided to the patient and her mother and the mother recorded the exercises with a cell phone for visual reference when performing the home program.

Detailed descriptions of all interventions are provided in Figure 1 and detailed description of intervention progression is provided in Table 6. Proper form for interventions is provided in Figure 1 with the common erroneous form. Interventions were selected to address joint instability and muscle weakness. Exercises were introduced as neuromuscular reeducation and were progressed to strengthening only after the patient gained control and activation. The American College of Sports Medicine reports that improvements in function before eight weeks are due to neuromuscular reeducation rather than strength improvement. [11] The patient demonstrated difficulty with aberrant movements during simple isolated isokinetic hip exercises like side lying hip abduction, prone over table hip extension and side lying clams. Biely et al found that aberrant movements, or patterns that deviate from the typical or expected movement

pattern, are associated with low back dysfunction. [11] Abdominal stabilization exercises included transverse abdominal drawing exercises and balance exercises. Kim et al found that drawing-in maneuver is the best abdominal contraction technique for maximizing transverse abdominus activation and minimize oblique musculature contraction.[12] Abdominal drawing exercises included isometric holds which were progressed to isometric holds with upper and lower extremity movements. Balance exercises included single leg stance with trampoline toss and was progressed to single leg stance on an Airex® brand foam pad. Strengthening exercises included both progressing the isokinetic hip exercises with ankle weights and adding exercises such as squats, side steps and monster walks with Theraband® brand latex bands. When used in conjunction with lumbar stabilization exercises, hip strengthening exercises have been shown to improve objective findings in patients with low back pain.[13] During the first week, the patient reported soreness that lasted 24 hours after the treatment.

During the third week of treatment, the patient demonstrated improvements in muscle activation with decreased aberrant movements during hip exercises. The patient also reported a decrease in muscle soreness at that time. Once muscle control was adequately established, the patient was progressed into strengthening parameters; this included the use of a red Theraband® instead of a yellow for side steps and monster walks.[14] The purpose of the prescribed interventions was to increase the stability in the lumbar spine.[15] All hip strengthening exercises like side lying hip abduction, prone over table hip extension, side lying clams, side steps and backward monster walks with Theraband® and squats with Theraband® were performed to address the weakness in the gluteus medias and maximus found during the performed tests and measures. All transverse abdominus exercises were prescribed to improve neuromuscular control of the transverse abdominus [16] and was progressed to include movements the patient would make during dance routines. It is well documented that task specific activities provide the most benefit

for movements within an activity.[13,17] All interventions for strengthening were progressed when patient was able to perform more than ten repetitions per set with correct control and form as deemed by the physical therapy student. [14] All endurance exercises like side steps were progressed when forty feet no longer produced soreness the next day or forty feet no longer caused fatigue. These criteria were reached based upon patient report.

The patient required education on the importance of her home exercise program early on in the plan of care but became adherent to the program shortly after. The patient missed three treatment sessions during the plan of care due to illness but all missed sessions were rescheduled and completed.

OUTCOME

Throughout the plan of care, the patient subjectively reported less difficulty performing exercises and a reduction in delayed onset muscle soreness. The patient's ODI score improved from a 62 percent during the initial evaluation to a twenty percent and seven percent at the four-week mark and discharge, respectively. Improvements in the severity of disability were apparent after just four weeks with continued improvement seen at discharge. This placed her in the mild to no disability category of the ODI. The patient's NPRS score also improved from a 6/10 to a 2/10 during discharge. MMT scores of transverse abdominus, hip extension and hip abduction improved to 3/5, 4/5 and 4/5, respectively. ROM, joint play assessment and resting posture showed no difference at discharge. Outcomes for the initial evaluation, the four week point and discharge are highlighted in Table 2.

DISCUSSION

Spondylolisthesis is a cause of back pain that may be linked to repetitive extension forces and muscular weakness associated with joint instability.[1] The purpose of this study was to assess the effectiveness of muscular strengthening and stabilization on the pain levels of a 14-year-old dancer. Based on tests and outcome measures, the patient seemed to benefit from a plan of care which included a structured strengthening program of the muscles believed to be important for lower back stabilization. Upon admission, the patient reported increased pain both at rest and during certain tasks. The findings of weakness, instability and excessive ROM deemed it appropriate to develop a plan to target stabilization with a progression from static to dynamic exercises.

After four weeks of treatment, the patient demonstrated significant improvement in MMT, NPRS score and ODI. When reevaluated during discharge, the improvements continued with the patient's pain almost becoming negligible allowing her to perform tasks with little difficulty. MMT improvements at the four-week mark may have been attributed to neuromuscular reeducation due to the patient becoming accustomed to the new movement pattern. However, during discharge, it was apparent that any MMT improvements were due to strength gain because of the linear progression in MMT and the need for increased resistance and difficulty of exercises.

Since it was hypothesized that the lack of ability to stabilize the lumbar spine while moving into lumbar extension was the cause of continued pain after the initial injury, the reduction in pain after strength gains demonstrated the importance of stabilization in young athletes. These findings are also consistent with Jeong et al,[13] who highlighted the importance of a stabilization and strengthening program of the gluteals and transverse abdominus to treat for lower back pain. Even though there is a general consensus to the treatment of low back pain

associated with spondylolisthesis, the importance of tailoring a plan of care for a young individual who participates in athletic activities, which may contribute to chronic problems, is evident. Further research is necessary to validate the effectiveness of stabilization and strengthening on the active youth population in both genders who participate in a variety of sports and exercise related activities. It may also be important to note the emotions and personalities of this patient population due to the possible skewed subjective reporting, this may be relevant for future research and clinical practice.

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476 **Table 1. Result of Systems Review**

Cardiovascular/Pulmonary	Cough, difficulty breathing, chest pain, digital clubbing, cyanosis, not present.
Musculoskeletal	Grossly Full ROM Significant hip weakness Anterior tilt, forward head. rounded shoulders posture.
Neuromuscular	Report occasional burning sensation in L5 dermatome both anterior and posterior.
Integumentary	Normal skin moisture, normal warmth.
Communication	Good understanding of written and spoken English.
Affect, Cognition, **Language, Learning Style**	Pt is alert and oriented to person place and time, with emotions that are typical for a 14-year-old female and prefers pictures and demonstrations as her preferred form of learning.

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Table 2. Results of Tests & Measures

Tests & Measures	**Initial Evaluation Results**	**Four Weeks**	**Discharge**
MMT			
Transvers abdominus	2/5	2+/5	3/5
Hip Extension	3/5	3/5	4/5
Hip Abduction	3/5	3/5	4/5
Joint Play			
Lumbar P-A Central	4/6	4/6	4/6
Lumbar P-A Unilaterally	4/6	4/6	4/6
Range of Motion			
Flexion	100%	100%	100%
Extension	100%	100%	100%
Rotation R&L	100%	100%	100%
Side Bend R&L	100%	100%	100%
Observation			
In standing	Anterior pelvic tilt	Anterior pelvic tilt	Anterior pelvic tilt
Palpation			
ASIS	Symmetrical	Symmetrical	Symmetrical
PSIS	Symmetrical	Symmetrical	Symmetrical
Malleoli	Symmetrical	Symmetrical	Symmetrical

Special Testing			
Supine to sit	-	-	-
Forward flexion test	-	-	-
Numeric Pain Rating Scale			
At Best	1/10	0/10	0/10
At Worst	6/10	4/10	2/10
Oswestry Disability Index			
Percent disability	62%	20%	7%

Table 3. Patient Goals

1. Pt will report decreased pain measure to 0/10 while at rest in order to sleep through the night in 3 weeks. 2. Patient will report decreased pain measure to 0/10 in the morning in order to get ready for school in 6 weeks.
1. Pt will decrease impaired percentage to 40-60 on the ODI in 3 weeks in order to attend to personal care. 2. Pt will decrease impaired percentage to less than 40 in order to stand for 30 mins at a time and complete a task in 6 weeks.
1. Pt will demonstrate improved muscle strength of transverse abdominus to 3/5 to fully participate in school without pain in 3 weeks. 2. Pt will demonstrate improved transverse abdominus strength to 4/5 in 6 weeks in order to ambulate in the community without pain.
1. Pt will improve gluteus strength to 4-/5 in order to avoid standing compensations in 3 weeks. 2. Pt will improve gluteus strength to 4+/5 in order to perform daily chores, especially in the morning without discomfort in 6 weeks.

509 **Table 6. Intervention Progression**

Intervention	**Progression**								
	Tx. 1 (Eval)	**Tx. 2**	**Tx. 3**	**Tx. 4**	**Tx. 5**	**Tx. 6**	**Tx. 7**	**Tx. 8**	**Tx. 9**
Side lying hip abduction – 2sets x 10reps	†	0#	0#	0#	1#	1#	1#	2#	2#
Prone over table hip extension – 2sets x 10reps	†	0#	0#	0#	0#	0#	1#	1#	1#
Side lying clams - Theraband® Color – 2sets x 10reps	†	None	None	None	Yellow	Yellow	Yellow	Yellow	Yellow
Side Steps with Theraband® Color – 2setsx40ft	‡	Yellow	Yellow	Yellow	Yellow	Red	Red	Red	Red
Backward monster walks with Theraband® Color – 2setsx40ft	‡	Yellow	Yellow	Yellow	Red	Red	Red	Red	Red
Squats with Theraband® around knees - 2sets x 10reps	‡	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow

Transverse abdominus isometrics 10seconds x 10 reps	†	□	□	‡	‡	‡	‡	‡	‡
Transverse abdominus isometrics with bent knee fall outs 2sets x 10reps	‡	‡	□	□	□	□	□	□	□
Transverse abdominus isometrics with mini marches 2sets x 10reps	‡	‡	□	□	□	□	□	□	□
Transverse abdominus isometrics with alternating shoulder flexion. 2sets x 10reps	‡	‡	‡	‡	‡	‡	□	□	□
Single leg stance with trampoline toss 2sets x 10reps	‡	‡	‡	Flat ground	Flat ground	Flat ground	Flat ground	Airex®	Airex®
* Tx – Treatment * Eval – Evaluation # - Pounds †– Instruction only ‡– Not performed □- Performed									

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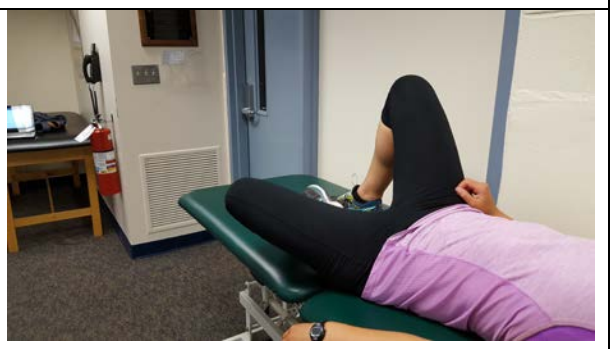
513 **Figure 1. Exercise Image Examples**

<table>
<tr><th rowspan="2">Intervention</th><th colspan="2">Photo</th></tr>
<tr><th>Incorrect</th><th>Correct</th></tr>
<tr><td rowspan="2">Side lying hip abduction</td><td>  </td><td>  </td></tr>
<tr><td colspan="2">Lying on one side. Flex lower leg’s knee and hip to comfort, extend upper leg’s knee and hip. Lift leg up toward the ceiling making sure to avoid flexing the hip and focusing on driving with the heel.</td></tr>
<tr><td rowspan="2">Prone over table hip extension</td><td>  </td><td>  </td></tr>
<tr><td colspan="2">Folded over the end of a table or bed. Slight bend in weight bearing leg. Extend non-weight bearing leg maintaining full extension in knee and avoiding back extension.</td></tr>
<tr><td>Side lying clams</td><td>  </td><td>  </td></tr>
</table>

	Lying on one side. Both knees and hips are flexed to 90 degrees and are on top of one another. Without rolling torso backward, the patient will lift the top knee off the lower knee keeping the feet together.	
Side Steps with Theraband® Akron, OH		
	Standing with slight flexion in knees and hips with Theraband® around forefoot. Driving with the heel, patient will step sideways.	
Backward monster walks with Theraband® Akron, OH		
	Standing with slight flexion in knees and hips with Theraband® around ankles. Driving with the heel and the toes pointing forward, the patient will step backwards at a 45-degree angle.	
Squats with Theraband® Akron, OH around knees		

<table>
<tr><td></td><td colspan="2">Squat down maintaining weight through heels and pushing out into the Theraband® while avoiding forward movement of the quadriceps.</td></tr>
<tr><td rowspan="2">Transverse abdominus isometrics</td><td>  </td><td>  </td></tr>
<tr><td colspan="2">Supine in hook lying position. Patient will palpate transverse abdominus with fingers (Find ASIS (anterior sacroiliac spine)) move medial one inch), draw abdomen down toward plinth. Avoid contraction of upper abdomen and pelvic floor.</td></tr>
<tr><td rowspan="2">Transverse abdominus isometrics with bent knee fall outs</td><td>  </td><td>  </td></tr>
<tr><td colspan="2">Supine in hook lying position. Patient will palpate transverse abdominus with fingers (Find anterior sacroiliac spine(ASIS)) move medial one inch), draw abdomen down toward plinth. Avoid contraction of upper abdomen and pelvic floor. Maintaining hook lying, abduct one leg and return to starting position, repeat with next leg, then relax transverse abdominus contraction.</td></tr>
</table>

<table>
<tr><td rowspan="2">Transverse abdominus isometrics with mini marches</td><td>  </td><td>  </td></tr>
<tr><td colspan="2">Supine in hook lying position. Patient will palpate transverse abdominus with fingers (Find anterior sacroiliac spine(ASIS)) move medial one inch), draw abdomen down toward plinth. Avoid contraction of upper abdomen and pelvic floor. Maintaining hook lying, lift one foot off the plinth one inch then repeat with the other foot then finally relax transverse abdominus contraction.</td></tr>
<tr><td rowspan="2">Transverse abdominus isometrics with alternating shoulder flexion.</td><td>  </td><td>  </td></tr>
<tr><td colspan="2">Supine in hook lying position. Patient will palpate transverse abdominus with fingers (Find anterior sacroiliac spine(ASIS)) move medial one inch), draw abdomen down toward plinth. Avoid contraction of upper abdomen and pelvic floor. Maintaining hook lying, flex one shoulder overhead then the next one then finally relax contraction.</td></tr>
</table>

Single leg stance with trampoline toss		
	Standing on one leg, drawing in transverse abdominus, and maintaining slight knee and hip flexion. Patent will throw a two-pound medicine ball at a trampoline and catch it with both hands while maintaining single leg stance.	

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