Use of Selective Functional Movement Assessment to Identify Impairments to Direct Pilates Programming: A Case Study

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5/7/17
2016/Synergy in Avon, CO
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Abstract:

The presence of Pilates-based exercise has increased in rehabilitation settings in recent years for patients with a wide range of diagnoses. While there are many methods of evaluating movement of patients before and after Pilates interventions, the author of this paper sought to utilize a more specific assessment to guide programming for Pilates sessions. This case report will highlight the use of the Selective Functional Movement Assessment (SFMA) to direct exercise selection for a patient with multiple functional movement dysfunctions.
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Gluteal muscles help stabilize the spine. An inability to activate gluteal muscles can lead to an over-recruitment of hip flexor muscles. Chronic sitting can reduce utilization and therefore cause deconditioning of the gluteal muscles. Image From (5).

The erector spinae muscles work to extend, sidebend/rotate, and stabilize the spine. Image From (2).

Trapezius and rhomboids work to posturally retract the scapula. The latisimus dorsi muscle works as a shoulder mover and extends and sidebends/rotates the lumbar spine. Image From (6).

Rectus femoris and psoas work to flex the hip. The hip flexor muscles work in conjunction to the gluteal muscles to help stabilize the lumbopelvic/hip region. Image From (8).
The presence of Pilates-based exercise has increased in rehabilitation settings in recent years for patients of a wide range of diagnoses. Pilates and modified Pilates exercises are good options when integrating therapeutic exercises into a plan of care or home exercise program during the rehabilitation process because of the mind-body approach it provides (4). There are several ways to assess patient movement pre- and post-Pilates sessions. Oftentimes, these measurements tend to only focus on one plane of motion and are potentially incomplete measures of functional movement. In order to understand how to most appropriately plan any individual exercise treatment program, Pilates or otherwise, it is imperative to be able to understand more contributing factors to that person’s movement patterns as a whole. This is especially necessary when dealing with clients who are symptomatic. “Inefficient and uneconomical movement patterns, once learned, will perpetuate the muscular imbalance and joint dysfunction that may have caused them” (4). With that said, assessment of those movement patterns for a client of Pilates needs to be fairly succinct in order to be able to progress into movement and exercise in a typical hour private Pilates session. This paper will highlight an assessment which can be utilized quickly and sufficiently and yield valuable information regarding clients movement patterns.

The Selective Functional Movement Assessment (SFMA) is an objective system, which assists healthcare professionals in applying a qualitative approach along with quantitative measurements in order to guide treatment of musculoskeletal pain and associated movement dysfunction using targeted interventions (1). The SFMA is based on the theory of Regional Interdependence, which views all regions of
the body as being “musculoskeletally linked” (7). The SFMA consists of a series of ten top-tier functional movements designed to assess fundamental movement patterns of individuals with known musculoskeletal pain (Appendix A) (1). These ten whole body movements are then further assessed via algorithms that dissect each pattern to identify the source of the dysfunction (1, 7). Patients are scored by both pain and function and given designations in each area of “Functional Non-Painful,” “Functional Painful,” “Dysfunctional Non-Painful,” or “Dysfunctional Painful.” Appendix B outlines the breakdown of how these four designations are given (1). The system is intended to identify meaningful impairments in order to efficiently guide the development and implementation of an individualized plan of care. While the SFMA is clearly intended for use in the diagnosis and treatment of patients presenting in a clinic with some form of symptomatic complaint, it can additionally be quite useful in cases where individuals are asymptomatic.

Patient A (name omitted due to HIPPA) presented with complaint of chronic neck and low back pain. She is a 59 year-old female with a long-standing complaint of neck and back issues likely and partially due to a persistent sitting workstation position during her 32-year career as an accountant. Patient A underwent surgery in 2011 for spinal fusion L4-S1. Previous to surgery, she enjoyed hiking, tennis, and golf in her free time, however she has been lax in participating in several of these activities due to pain and overall physical deconditioning. Postural assessment revealed significant forward head posture with a kyphotic thoracic spine. Her posture additionally suggests Patient A has decreased firing and recruitment of her abdominal and gluteal muscles.
The SFMA for Patient A revealed Functional Non-Painful flexion, extension, and rotation of her cervical spine (TABLE 1). She also demonstrated Functional Non-Painful shoulder patterns. Patient A scored Functional Non-Painful on multisegmental flexion. During multisegmental extension however, she tested Dysfunctional Non-Painful. Following the algorithm breakout for the Dysfunctional Non-Painful score in multisegmental extension (as highlighted in Appendix C), Patient A continued to score Dysfunctional Non-Painful through backward bend without upper extremity, single leg backward bend, press up, lumbar locked external rotation, and active and passive lumbar locked internal rotation. Ultimately this led to Patient A’s first dysfunctional movement diagnosis of “thoracic extension and rotation joint mobility dysfunction and/or tissue extensibility dysfunction.” Therefore, following the SFMA, initial interventions for Patient A should address and focus on improving her thoracic mobility/tissue extensibility. The information from the SFMA was then combined with postural assessment and patient history to start a focused Pilates rehabilitation program.

To help Patient A improve her functional movement patterns while a patient in the clinic but also address life outside of the clinic, a clinical Pilates program was developed for her in addition to a brief home-based mat program and office stretching program. Special attention was paid to the inclusion of exercises which would address Patient A’s dysfunctional movements as identified by the SFMA, specifically thoracic spine rotation and extension. Exercises were also included to address postural concerns including abdominal and gluteal strength, hip flexor lengthening, and scapular retraction. While the clinical program followed the BASI
block system, the programs for at home and in office were kept brief for this patient in order to ensure the integrity of exercises were maintained as well as patient compliance. Exercises for these programs were chosen based on which exercises the clinician felt comfortable would be completed correctly as well as those that would most effectively address the areas of highest concerns per the SFMA. Patient A was additionally given a short exercise program to complete at her office each day several times throughout the day. Exercises for this included a seated thoracic chair stretch, brief breaks for walks around the office, and foam roller postural mobility exercises. It was further recommended that Patient A change her workstation to a standing workstation with correct ergonomics.

The clinical program and home-based mat program are as follows:

**Clinical Program:**

- **Fundamental Warm Up:** pelvic curl, spine twist supine, chest lift, chest lift with rotation.
- **Footwork on Reformer:** parallel heels, parallel toes, V position toes, open V heels, open V toes, calf raises, prances, prehensile, single leg heel, single leg toes.
- **Abdominals:** hundred prep, coordination
- **Hip Work:** frog, circles down, circles up, openings
- **Spinal Articulation:** bottom lift
- **Stretch:** standing lunge
- **Full Body Integration:** flat back, down stretch, long stretch
- **Arms:** supine arm series; extension, adduction, up circles, down circles, triceps
• **Legs:** leg press standing (Wunda chair), single leg skate
• **Lateral Flexion/Rotation:** mermaid, side stretch (Wunda chair)
• **Extension:** breaststroke prep, swan basic (Wunda chair)

**Home-Based Mat Program:**

- **Foundation:** pelvic curls, spine twist supine
- **Bridging:** shoulder bridge prep, front support
- **Back Extension:** swimming, cat stretch

It is important to state that while the BASI block system was followed for the development of Patient A’s Pilates program, the premise of correcting mobility/tissue extensibility deficits before performing stability exercises from the SFMA was implemented in treating this patient and therefore some brief stretching was done prior to beginning the BASI blocks. Those stretches included shoulder stretch sidelying and thoracic mobility stretches on the foam roller.

Following 8 weeks of treatment Patient A was re-evaluated and found to have decreased overall symptoms. She has no complaint of low back pain and a significant decrease in neck pain. SFMA follow-up reveals improving multisegmental extension although it still remained dysfunctional non-painful. Patient A has decreased forward head posture and improved scapular retraction. She returned to playing tennis and is continuing bi-weekly Pilates sessions.

There is a need for a succinct assessment of movement dysfunction for a more effective integration of Pilates exercise programming in Physical Therapy settings. Inefficient movement patterns once learned will perpetuate the muscular imbalance and joint dysfunction that may have caused them (4). Exercise programs
often fail to assess or address this aspect of training. As a result, altered movement patterns are not identified and re-educated (4). Use of the SFMA can be beneficial in guiding a more effective Pilates program for both patients presenting with symptoms and for those who are asymptomatic.
Bibliography


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<thead>
<tr>
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<tbody>
<tr>
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<td>FN</td>
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<tr>
<td>Cervical Extension</td>
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<tr>
<td>Cervical Rotation</td>
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<td>Deep Squat</td>
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FN=Functional Non-Painful, DN=Dysfunctional Non-Painful, LRA=Lateral Rotation/Abduction, MRE=Medial Rotation/Extension
## Appendix A:

### The Selective Functional Movement Assessment

<table>
<thead>
<tr>
<th>SFMA Scoring</th>
<th>FN</th>
<th>FP</th>
<th>DP</th>
<th>DN</th>
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### THE SELECTIVE FUNCTIONAL MOVEMENT ASSESSMENT

<table>
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<th>Name:</th>
<th>Date:</th>
<th>Total Score:</th>
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#### Cervical Flexion
- [ ] Painful
- [ ] Can’t touch Sternum to Chin
- [ ] Excessive effort and/or lack of motor control

#### Cervical Extension
- [ ] Painful
- [ ] Not within 10 degrees of parallel
- [ ] Excessive effort and/or lack of motor control

#### Cervical Rotation
- [ ] Painful Right
- [ ] Painful Left
- [ ] Right: Noe not in line with mid-clavicle
- [ ] Right: Excessive effort and/or appreciable asymmetry or lack of motor control

#### Pattern 01 – MRE
- [ ] Painful Right
- [ ] Painful Left
- [ ] Right: Does not reach inferior angle of scapula
- [ ] Right: Excessive effort and/or appreciable asymmetry or lack of motor control

#### Pattern 02 – LRF
- [ ] Painful Right
- [ ] Painful Left
- [ ] Right: Does not reach spine of scapula
- [ ] Right: Excessive effort and/or appreciable asymmetry or lack of motor control

#### Multi-Segemental Flexion
- [ ] Painful
- [ ] Cannot touch toes
- [ ] Sacral angle <70 degrees
- [ ] Non-uniform spinal curve
- [ ] Lack of posterior weight shift
- [ ] Excessive effort and/or appreciable asymmetry or lack of motor control

#### Multi-Segemental Extension
- [ ] Painful
- [ ] UE does not achieve or maintain 170
- [ ] ASIS does not clear toes
- [ ] Spine of scapula does not clear heels
- [ ] Non-uniform spinal curve
- [ ] Excessive effort and/or lack motor control

#### Multi-Segemental Rotation
- [ ] Painful Right
- [ ] Painful Left
- [ ] Right: Pelvis Rotation <50 degrees
- [ ] Right: Shoulders rotation <50 degrees
- [ ] Right: Spine/pelvic deviation
- [ ] Right: Excessive Knee flexion
- [ ] Right: Excessive effort and/or lack of symmetry or motor control

#### Single Leg Stance
- [ ] Painful Right
- [ ] Painful Left
- [ ] Right: Eyes open <10 seconds
- [ ] Right: Eyes closed <10 seconds
- [ ] Right: Loss of Height
- [ ] Right: Excessive effort or lack of symmetry or motor control

#### Overhead Deep Squat
- [ ] Painful
- [ ] Loss of UE start position
- [ ] Tibia and Torso are not parallel or better
- [ ] Thighs do not break parallel
- [ ] Loss of sagittal plane alignment
  - Right: __________ Left: ________
- [ ] Excessive effort, weight shift, or motor control
Appendix C:

**MULTI-SEGMENTAL EXTENSION BREAKOUTS**

1. **Spine Extension Flowchart**
   - Backward Bend w/o UE
     - DN, DP or FP
     - FN → Go to UB Ext. Flowchart

2. **Single Leg BB**
   - DN, DP or FP
   - FN

3. **Press Up**
   - Symmetrical Stance Core SMCD or Anterior Torso TED - Go to UB Ext. Flowchart
   - FN

4. **Weight Bearing Spine Extension SMCD, Go to Lower & Upper Body Ext. Flowcharts**
   - DN, DP or FP (> 1 Airex Pad)

5. **Lumbar Locked (IR) - Active Extension/Rotation (50°)**
   - DN, DP or FP

6. **Lumbar Locked (IR) - Passive Extension/Rotation (50°)**
   - FP or DP
   - FN
   - Thorac Ext./Rot. JMD &/or TED - Go to Lower Body Ext. Flowchart
   - DN

7. **Active Prone on Elbow Unilateral Extension/Rotation (30°)**
   - DN, DP or FP
   - FN
   - If T-spine has SMCD assume L-Spine is normal.

   - FP or DP
   - DN
   - FN
   - Weight Bearing Spine Ext. SMCD or Ant. Torso TED - Go to LB then UB Ext. FC

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