Pilates for Anterior Cruciate Ligament Rehabilitation

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Abstract

There are approximately 200,000 ACL injuries per year in the United States (Gammons). The ACL is one of four ligaments that attach the femur to the tibia, and keeps the tibia from sliding in front of the femur (see page 3). Girls have a higher incidence of ACL injury at a rate of four to six times that of boys. A primary cause of the higher rate in girls is neuromuscular differences. Girls tend to use more quadricep which causes more instability in the knee, as opposed to the hamstring which absorbs more of the impact of movement (Osbourne).

In rehabilitating an ACL injury, a strong focus is placed on strengthening the muscles around the knee joint, the core, and the technique of movement. Pilates is perfect for this, because it provides balance in the entire body (including the quadriceps and hamstrings), stability, and requires tremendous thought about muscle recruitment and technique through the BASI method.
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Anterior Cruciate Ligament

(ACL)

The ACL is one of four ligaments that attaches the femur to the tibia, critical to the stability of the knee joint. The ACL creates a cruciate (cross) with the posterior cruciate ligament (PCL), both attaching to femur and tibia on opposite sides, contributing to the stability in angulation and rotation of the knee joint. Injury to the ACL is most often a non-contact injury while quickly stopping or changing direction while running, landing, or turning. It can also occur from a tremendous impact to the side of the knee, or hyperextension of the knee joint. Balance between the hamstring and quadricep muscles, as well as a focus on the vastus medialis oblique, is essential to help support the knee joint (Osbourne).
Case Study

(I chose to pull from my own experiences with ACL injury and Pilates)

Vaughn was a 16 year old, who completely tore her ACL during a soccer game three years ago while making a fast change of direction while running. She underwent reconstructive surgery and had her ACL replaced with a cadaver tendon. The recovery was a six month recovery back to running, she did not return to playing soccer because of the fear her body wasn’t strong enough or capable enough. She tried running and dancing but both were too strenuous on her knees. She experienced joint stiffness, achiness, and occasionally a sharp pain with certain movements. She did not feel her knee was truly stable or strong enough for her to physically perform the way she would like to. Three years later, she discovered Pilates. Since Vaughn was three years out from surgery and physical therapy, she did not have any limitations.

Vaughn needed a full body conditioning program with a strong focus on knee stability and the strengthening and balancing of the quadriceps and hamstrings. This also pertained to the ankle and hip joints, as well as core strength and stability. The quadriceps are an important component to knee stability as well, working together with the hamstrings and gastrocnemius, to support the joint (Isacowitz). If these other components are not functioning properly, much less well, they will have an adverse affect to the stability of the knee. These muscles would include the hip adductors, abductors, and hamstrings which are flexors of the knee joint. Pelvic lumbar stabilization, through a strong pelvic floor and transverse abdominals, will also be very helpful in the correct recruitment of her lower extremity.
Vaughn’s Conditioning Program

<table>
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<tr>
<th>BASI Block</th>
<th>Sessions 1-5</th>
<th>Sessions 6-10</th>
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<tbody>
<tr>
<td>Warm up</td>
<td>Pelvic curl</td>
<td>All from session 1-5, plus Roll up.</td>
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<td></td>
<td>Leg changes</td>
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<tr>
<td></td>
<td>Supine Spine Twist</td>
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<tr>
<td></td>
<td>Chest Lift</td>
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<td></td>
<td>Chest Lift w/Rotation</td>
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<td>Footwork</td>
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<td>Abdominal Work</td>
<td>Hundred Prep, Hundred, Coordination</td>
<td>Reverse Pike Standing</td>
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<td>Arm Work</td>
<td>Supine Arm Series</td>
<td>Tricep Press</td>
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<tr>
<td>Stretches</td>
<td>Standing Lunge</td>
<td>Kneeling Lunge(if okay on knees)</td>
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<tr>
<td>Hipwork</td>
<td>Cadillac</td>
<td>Reformer</td>
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<tr>
<td>Spinal Articulation</td>
<td>Bottom Lift w/ Rollup Bar</td>
<td>Bottom Lift w/Extension, Roll Over</td>
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<tr>
<td>Full Body Integration I</td>
<td>Sitting Forward, Side Reach</td>
<td>Knee Stretch Round Back (if okay on knees)</td>
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<td>Full Body Integration II</td>
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<td>Leg Work</td>
<td>Sitting Series, Gluteals Side Lying Series</td>
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<td>Lateral Flexion &amp; Rotation</td>
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<td>Back Extension</td>
<td>Basic Back Extension, Single Leg Kick</td>
<td>Pulling Straps I</td>
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Each exercise in Vaughn’s condition program was chosen specifically for full body conditioning in addition to the acute goals. The most immediate goal was to work
the knee in an inherently stable way to repossess balance and gain strength. After about twenty sessions (ideally), Vaughn did more strength work, and eventually purposefully challenged the stability of the knee while carefully recruiting the correct muscles.

The footwork promotes the proper firing of the hamstrings along with ankle and knee alignment. The V, and Open V Heel/Toes are wonderful for strengthening the hip adductors. The correct recruitment and form in using the leg muscles will build strength and balance of the muscles surround the knee joint such as the hamstrings, quadriceps (Vastus medialis), and ankle muscles. This imbalance between the strength/use of the quadriceps was mentioned earlier because it is one of the main causes of ACL injuries in young women and so is crucial to focus on correcting. Footwork also requires trunk/pelvic stability and core strength which will support the proper engagement of the muscles surrounding the knees. At first, we worked on just the basic footwork and over time added more challenges. Footwork is extremely valuable when done correctly for the lower limbs.

I chose the hundred prep, hundred, and coordination because they require both core strength and trunk stability. The movement of the arms in the first two requires tremendous focus to recruit the correct muscles and keep the movement smooth. Coordination is exactly what it says, it challenges the mind body connection while providing challenging abdominal work. I also chose to put the Supine Arm series here after abdominal work for flow, and it requires intentional stabilization of the knee while
the legs are in table top. The series is a challenge for the abdominals while also
strengthening the shoulder girdle.

The series of hip work on both the cadillac and the reformer are both excellent,
and slightly more challenging, for leg strength and trunk/pelvic stability. The hamstrings
and hip adductors are the primary muscle focuses, yet the entire leg is working in
harmony to provide hip disassociation and smooth movement. The hip work on the
Reformer is a great place to begin because it is more stable than the cadillac hip work,
which is unilateral. I moved up to the cadillac hip work when Vaughn gained more
strength and control, understanding how the movement should feel.

The leg work is also very essential to addressing the imbalance of the use of the
leg muscles. The magic circle series directly targets the hip adductors and the muscles
around the knee. It is great because it can be done in different positions, increasing in
difficulty, and it is very focused, precise work. Skating is a great addition because it
requires stability of the knee joint in order to properly recruit and use the gluteus
medius. The gluteus medius, a hip abductor and external rotator, is essential to the
stability of the hip joint and in turn the knee joint. Its strength is reflective of the strength
and stability of the knee. The quadriceps are an important component to knee stability
as well, working together with the hamstrings and gastrocnemius, to support the joint.
(Isacowitz).

Stretching is effective and important to the flow and enjoyment of a BASI
session. The standing lunge is a great place to start to stretch the hip flexors and
hamstrings. Just as it is important to strengthen the muscles, it is important to make sure the muscle is supple in the full range of its motion. A short, tight muscle is not a strong muscle!

We did not get to spinal articulation and the full body integration blocks at first, because of the time and focus I put on the foundation work. As Vaughn became more aware of her body these blocks became more and more valuable (as all blocks do). The exercises I chose would all be great fundamental exercises to start these blocks.

I chose to start with Mat work for lateral flexion and back extension blocks at first. Side lifts and basic back extension are so valuable to learn how to recruit your lateral flexors/obliques and back extensors. They provide the perfect foundation to move onto more challenging work on the equipment. The side lifts are wonderful too because, not only are your obliques doing tremendous work, but your inner thighs are active.

Pilates is a great way to strengthen and support the knee after ACL reconstruction as well as the entire body. The method provides balance and strength which is essential to a vital, engaging life. After 10 sessions Vaughn was hooked and loved Pilates. She noticed that it increased her strength and confidence in her body. The aching she experienced frequently decreased and she loved the physical and mental challenge Pilates could challenge her without the impact on her knees and body. 4 years later she chose to turn her passion into a career! Looking at the big picture as well, Vaughn felt getting injured at such a young age she had lost a large part of her identity with being physically fit and her trust and confidence in her body. Pilates has
helped her to love, trust, and cherish not only her body again but her life! When you
discover what amazing things your body can do and how truly good “strong” can feel -
you will never go back!
Bibliography


