Pilates: Rehabilitation for Senior Female Tennis Player with Knee Osteoarthritis

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Abstract

This case study is focused on an elderly female who is an avid tennis player recently diagnosed with bilateral knee osteoarthritis. A large population of the elderly deals with some type of osteoarthritis as they age and exercise such as pilates rehabilitation can help with strengthening, flexibility, mechanics, posture and overall body awareness. This paper will reveal how exercise and strengthening is important to people dealing with arthritis, specifically pilates rehabilitation due to its low impact on joints. Pilates was developed by Joseph Pilates. Over his livelihood he created over 600 exercises for several pieces he invented which was arranged to shape the entire body using distinct positions and flow to restore body alignment and balance. Exercise is vital in managing arthritis and getting one back to their everyday activities and exercise without pain.
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Anatomy of the knee

The knee joint consists of four bones: the femur, the tibia, the fibula and patella consisting of the lateral and medial tibiofemoral and patellofemoral joints. The distal end of the femur expands into the lateral and medial femoral condyles which articulate with the tibia and patella. The patella is located in the quadriceps tendon on the front of the knee and glides up and down in the trochlear groove between the femoral condyles as the quadriceps muscle contracts and relaxes. Motion and the knee occurs in two planes, flexion and extension in the sagittal plane and internal and external rotation in the horizontal plane. The ligaments, joint capsule,
meniscus and muscles which surround the knee are the primary stabilizers of the knee. The knee provides stability in weight bearing and with mobility. The medial and lateral meniscus act as shock absorbers and help cushion any stresses places on the knee joint. The major stabilizing ligaments of the knee include the cruciate and collateral ligaments. The anterior cruciate ligament (ACL) prevents the femur from moving posteriorly during weight bearing and stabilizes the tibia against excessive internal rotation. The posterior cruciate ligaments (PCL) prevents the femur from gliding forward during weight bearing. The medial and lateral collateral ligaments (MCL and LCL) function to stabilize the knee against side to side (valgus/varus) forces at the knee joint.
The quadriceps is made up of 4 muscles and is the anterior thigh muscle responsible for knee extension; rectus femoris, vastus medialis, vastus lateralis and vastus intermedius. The hamstring is made up of 3 muscles on the posterior thigh and is responsible for knee flexion; semitendinosus, semimembranosus, and biceps femoris. Gracilis, sartorius, popliteus, gastrocnemius and plantar is are also involved in knee flexion. The popliteus, semitendinosus, semimembranosus, sartorial, and gracilis are responsible for internal tibial rotation. Biceps femoris is responsible for external tibial rotation. The muscles that stabilize the hip are also very important for proper function of the knee, specifically the gluteus medius and maximus.
Osteoarthritis (OA) is also known as degenerative joint disease which is one of the most common chronic conditions of the joints. OA affects the natural cartilage between the joints where healthy joints are well cushioned by cartilage and synovial fluid. As the cartilage wears down the bone, the ligaments and muscles underneath begin to deteriorate as well. OA occurs in all joints of the body, but the knee and hip are most prevalent. OA has no specific cause but can be caused by several different factors including genes, excess weight, injury and over use, and other chronic conditions or immune disorders. This is why diagnosis of the underlying cause is key to determine the appropriate plan of care.

The most prevalent symptoms of patients with knee OA include pain, stiffness, limited range of motion, edema, crepitus and in turn loss of function with activities of daily living and functional activities including exercise. For most types of arthritis, there is no cure, but treatments such as exercise to help significantly decrease the amount of pain and improve your mobility throughout the day. Arthritis can be diagnosed through certain tests, most commonly an x-ray is performed. Exercise is one of the main conservative treatments for OA, patients will be sent to physical therapy, aquatic therapy, pilates, yoga, walking programs, etc in order to strengthen, improve flexibility, increase range of motion, improve gait/balance and in turn decreased pain and improve overall function. Other treatments include weight management, medications, and injections (cortisone, syn visc, or protein rich plasma). If the arthritis has gotten severe and painful, surgery is the next option. Less invasive would be arthroscopic surgery and more invasive would result in a total knee replacement.
Case study

Emily is a 68 year old female tennis player recently diagnosed with bilateral knee osteoarthritis. She began having pain about 1 year ago in both knees, but her right is far worse than her left. She has been playing tennis for the last thirty years and had to stop recently due to her knee pain. Over the last few years she has noticed twinges of pain which has affected her speed and endurance which is affecting her game. She stopped playing singles months ago and recently had to stop playing doubles. She normally plays with opponents substantially younger than her and is unable to keep up at this point. Initially her pain began with stairs, squatting and when performing household chores. She will use stairs one at a time and bend at her back when squatting to limit her pain, but this will often cause low back pain. She avoids kneeling and has recently started using a cleaning lady to help with chores to manage the pain. She was recently prescribed anti-inflammatories which significantly reduce her pain, but she does not want to get used to taking medications if she can get results with other treatments. She performs stretches sporadically after playing tennis, but nothing consistent. Her doctor suggested Physical Therapy and Pilates for strengthening.

She complains of morning stiffness and knee pain which radiates down her lower leg. Currently her left knee has been feeling significantly better, therefore she wanted to focus on the right knee. Emily would like to learn what she can do to prevent her from arthritis from getting worse and be able to squat/jog in order to return to tennis. She was educated on the importance
of Pilates based rehabilitation specifically due to the decreased impact it places on the joints and
the importance of a consistent home exercise program in order to manage and maintain strength,
flexibility, balance and range. In the long run to perform low impact exercise such as swimming/
water aerobics, and to play sports on softer vs harder surfaces to minimize impact of the joints to
minimize the further degeneration in her joints.

Function/observation: poor form with double leg mini squat with pain in the right knee; femoral
internal rotation R > L leading to impaired mechanics

Palpation: tender to touch along medial joint line, medial patellar margin, pes anserine, distal
iliotibial band (ITB), and proximal lateral gastroc head.

Balance/proprioception: R SLS 3-4” moderate sway indicating decreased ankle strategy

Gait: decreased terminal knee extension in stance and decreased heel off in terminal stance
contributing to limited knee/hip flexion in swing phase of gait.

Flexibility: decreased hamstring, quad, hip flexor and ITB length. Pain with knee flexion

Strength: Quadricep, hamstring and gluteal weakness

Emily went through 4 weeks of physical therapy and is now transitioning to Pilates. She was
advised by her doctor and therapist to use a knee brace when returning back to tennis. Her pain
has reduced since starting therapy and she would like to continue strengthening. Using the BASI
Block system a conditioning program was created within the 12 blocks; warm up, foot work,

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abdominal work, hip work, spinal articulation, stretches, full body integration (FBI)
((fundamental/intermediate)), arm work, FBI (intermediate/master), leg work, lateral flexion/rotation and back extension. However, full body integration (I/M) was not included in the first 20 sessions.

Conditioning program

Roll down

**Fundamental Warm up**  Mat: roll up, pelvic curl, spine twist supine, chest lift, chest lift with rotation. This warm up is a good way to engage the muscles around the hip and trunk. The pelvic curl emphasizes spinal articulation, pelvic lumbar stabilization, lower extremity alignment hamstring/gluteal control. Spine twist supine and chest lift with rotation are similar but has oblique emphasis w/ spinal rotation.

**Foot work**  Reformer: parallel heels/toes, V-position toes, open V position heels/toes, calf raises, prances, single leg heel/toes. This series focuses on body alignment starting from the feet up towards the pelvis emphasizing hip extensor, knee extensor and plantar flexion strength. The single leg foot work isolates the alignment and strength of each leg and reveals Emily’s right leg is weaker

**Abdominal work**  Reformer: hundred prep and coordination. This block focuses on abdominal strength and pelvic lumbar stabilization. Emily needed moderate cues to avoid neck involvement
**Hip work** Reform: supine leg series: frog, circles (up/down), and openings. This series is ideal for Emily as it focuses on hip adductor and extensor control and strength which are her weaknesses.

**Spinal articulation Mat:** Rolling like a ball and spine stretch. In order to maintain pelvic and lower extremity alignment, spinal flexibility is vital. Both of these stretches focus on spinal/trunk stabilization where spine stretch also emphasizes hamstring flexibility.

**Stretches** Reform: standing lunge. Emily would benefit from all lower extremity stretches, the standing lunge is perfect for Emily as she can isolate stretching both hip flexors and hamstrings in a functional position which she can carry over on the tennis court.

Pole series: shoulder stretch, overhead stretch, side stretch, spine twist. Being a tennis player it is important for Emily to stretch the upper body and trunk in addition to the lower body.

**Full body Integration (F/I)** Reform: Scooter. This is a great overall body strengthening exercises which focuses on trunk/shoulder stabilization and hip/knee extensor control and strength. Focusing on hip disassociation helped Emily maintain pelvic stabilization. Emily’s right leg is weaker than her left which is noticeable with this exercise.

**Arm work** Reform: Arm supine series. This series is great for pelvic and scapular stabilization which are both important component for a tennis player.

**Full body Integration (I/A):** N/A
**Leg work** Mat: Gluteal side lying series (side leg lift, forward and lift, forward with drops).

Gluteal control and strength is vital for postural control/alignment and overall body strength. This series was challenging for Emily, we started with 5-7 reps and increased up to 12-15 once her strength improved.

Wunda Chair: Leg press standing. This exercise aims to work on Emily’s balance and control while standing on one leg and strengthening her hamstrings and gluteals. Initially she needed uni-lateral upper extremity support, but after a few sessions she gained the strength and control to balance for this exercise.

**Lateral flexion/rotation** Wunda Chair: side stretch. This exercise emphasized Emily’s weakness and flexibility on her right. She had difficulty dissociating her lower body from her upper body with lateral flexion.

**Back Extension** Wunda Chair: swan basic. The exercise was used to achieve back extensor/core strength. Emily was limited in her back extension ROM due to spinal hypo mobility and strength.

Roll down

This program was initiated and modified for Emily’s first 20 sessions using the BASI block system in order to improve body awareness, flexibility, postural/pelvic alignment, strengthening her abdominals, hip and knee stabilizers, increasing her static balance and in turn her function has improved. Her pain continues to decrease with activities of daily living and she is able to perform chores around the house, squat and play doubles without pain (using a knee
brace). As she progressed past the 20 sessions, the intermediate repertoire was introduced in addition to the jump board to mimic specific jumps and movements performed in tennis.

## Conclusion

During Emily’s rehabilitation we focused on postural alignment, flexibility, spinal articulation, balance and core and upper/lower extremity strength. She was able to improve her strength, balance, flexibility and gait pattern within a few months of therapy and pilates rehabilitation. The use of all apparatus’ not just the mat, gave her tactile cues and feedback. She is more aware of her posture and lower extremity alignment using stairs and walking which has helped reduce her pain. Her increased strength and flexibility has in turn improved her alignment and pain with functional activities throughout the day in addition to her speed and endurance thus allowing her to return to playing doubles. Emily was content with her progress over the last few months and is continuing Pilates regardless of her lack of pain and has informed several of her friends and family who are also dealing with osteoarthritis.
Books:


Websites:


Pictures:


