Pilates for the Cancer Survivor with Osteopenia

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January 2016

BASI CTTC 2014

South Pasadena, CA
ABSTRACT

Although seemingly rigid and lifeless, our bones are made of living tissue that constantly rebuild new cells and break down old cells. Unfortunately, there are many factors that can slow down the bone building cells, speed the process of bone density loss, and increase the likelihood for Osteopenia or Osteoporosis. In the following case study, we examine a female cancer survivor who experienced early menopause and the loss of bone density, which prompted her search for an affordable, effective exercise strategy to help build stronger bones and prevent her Osteopenia from progressing to Osteoporosis. For the purpose of this study and the goals of the client, BASI Mat and Auxiliary repertoire were used in developing a safe and accessible Pilates program to effectively incorporate functional strength training and improve bone density levels.
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ANATOMICAL ANALYSIS

Bone Structure

In the U.S., Osteoporosis is a widespread epidemic that is often ignored by many. This condition increases the risk for bone fragility and fractures, even when carrying out common household tasks that may normally seem harmless (Betz 47). Osteoporosis is described as “a systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of bone tissue” and affects 10 million Americans today (Betz 48). Osteopenia indicates a milder loss of bone mass, but points to the onset of Osteoporosis. In order to stop or slow down the progression of the disease, it must be treated proactively. The 34 million Americans who are currently diagnosed with Osteopenia are all at risk for Osteoporosis and future related bone fractures (Paterson 59).

In order to understand the reason for fracture risk and attempt to prevent it, we must look at the different types of bone structure. The bones in our arms and legs are made of a harder, compact cortical bone, while our vertebrae, hip, and joint surfaces are made of a softer, sponge-like trabecular bone. The latter of the two makes up only 20% of our bone structure, but has a much higher cell turnover rate, making it more susceptible to fractures. Within the bone structures, there are “osteoblasts” that build bones and the “osteoclasts” that clean bones and there usually exists a consistent balance between the two unless they are compromised. When a disease such as Osteoporosis is present, the bone cleaners continue to work at the same speed, while the bone builders begin to slow down, leading to the likely drop in bone mass and density (Betz 49).

Flexion versus Extension

There is a tendency to focus on preventing fractures in the thoracic spine because the vertebral bodies are smaller, more fragile, and more prone to the disease. Research shows that most fractures occur between T6 and T8 and placing pressure on these areas of the spine are especially sensitive. When
the spine flexes forward, more force is placed on the anterior surface of the vertebrae where most of the trabecular bone exists. If these bones have already been weakened by Osteopenia or Osteoporosis, the risk of wedging or fractures increases as the excessive load increases (Betz 51). In Figures 1 and 2 below, there is a clear comparison between a normal, healthy vertebra and one that has suffered from compression fractures. Although they may seem small at first, a multitude of fractures can eventually change the shape of the spine and lead to postural deformities, problems with circulation, a compressed digestive system and other consequences that might make it more difficult for the body to function efficiently. Therefore, exercises that flex the spine forward or place heavy loading on the vulnerable bone tissue, such as extreme lateral flexion or rotation, should generally be avoided for those with Osteopenia or Osteoporosis.

Extension exercises, on the other hand, have been shown to strengthen the back extensor muscles and the spine. Since the posterior vertebrae are mostly composed of the stronger cortical bone, the movement of the spine in extension is a safer, more effective way to load the spine. Various research studies performed by Mehrsheed Sinaki, MD even showed that “strong back extensors correlated with fewer vertebral fractures and increased bone mineral density” (Betz 51). In a study done by Sinaki and Beth A. Mikkelsen, MD in 1984, four different groups with postmenopausal osteoporosis and back pain were assigned four respective treatment exercises including 1) extension; 2) flexion; 3) extension + flexion; and 4) no therapeutic exercise. The results showed that additional vertebral compression fractures occurred in 16% of the extension only group, 89% of the flexion only group, 53% of the extension + flexion group, and 67% of the group with no therapeutic exercise (Sinaki and Mikkelsen 593). This suggests how dangerous it can be for Osteoporotic clients to flex the spine forward excessively and how risky it can be for clients to avoid exercise altogether. Sinaki and Mikkelsen’s findings were extremely important in setting the tone for discussing and developing safe exercise treatments for clients with Osteopenia and Osteoporosis and are still widely referenced today.
Bone Mineral Density

Although many postmenopausal women are victims of Osteopenia and Osteoporosis, postmenopausal women who have also received cancer treatment are at an even higher risk since the drop in estrogen and other hormone levels contribute to the loss of bone mineral density. Bone mineral density or “BMD” refers to the strength of the bone and is the main form of measurement taken by a DXA (dual-energy x-ray absorptiometry) scan when determining a patient’s diagnosis and degree of bone disease (Betz 51). The test results reveal a T-score that is compared with the BMD of an average 25-30 year-old adult. Osteopenia is diagnosed when the T-score falls between -1 and -2.5 below the mean and Osteoporosis is diagnosed if the T-scores falls any lower than -2.5 (Betz 48).

A detailed close-up in Figure 3 below illustrates the fragility and weakness in a less dense osteoporotic bone. To prevent further bone density loss, patients must “increase peak bone mass and reduce the rate of bone loss by regular weight bearing exercise…” (Paterson 60). Since this disease is a
silent one, both men and women over 50 years old should consider a BMD test, so that contraindicated exercises can be avoided and appropriate strength training can be regularly incorporated for stronger, healthier bones.

CASE STUDY

Introduction

Attempting to treat postmenopausal osteopenia with a Pilates exercise program can seem like a challenging task. However, we do know from previous research that regenerating bone tissue is feasible, especially through weight-bearing exercise. We also know that we should treat clients with Osteopenia with the same amount of care as Osteoporotic clients, particularly when avoiding exercises in thoracic flexion where the spine is more susceptible to fractures. A successful Pilates program should combine core strength, joint mobility, resistance training, balance and functional movement to help encourage bone-building and prevent future fractures. These key components will be applied in the case study below through weekly Pilates classes over the period of 10 months.

Background and Previous Treatments

Marie, a 62-year-old female breast cancer survivor, first discovered she had Osteopenia in 2001 after deciding to participate in a free bone density screening at a local health fair booth. Following the peripheral test taken from her heel bone, she was strongly urged to contact her doctor immediately so she could schedule a Central DXA test. More than two years had passed since her last cancer treatment, and no one had advised her to get a bone density test or mentioned the potential risk of getting Osteopenia or Osteoporosis. She had already endured a lumpectomy for breast cancer (ductile carcinoma in situ-early stages) in 1998 and a combination of six weeks of radiation treatment and two separate rounds of chemotherapy in 1999. In the same year, she experienced early menopause and a severe case of depression following the end of treatment. With that amount physical and emotional stress, hormonal imbalances and other changes in the body, it is not a surprise that BMD scores were already indicating Osteopenia.
In 2005 (the earliest record available), results showed a -2.1 T-score for Marie’s lumbar spine and a -2.3 T-score for her femoral neck (no significant scores for total hip). These scores were not very far from the -2.5 and below levels that would indicate Osteoporosis. Her doctor prescribed Fosamax, a medicine that is now thought to have the reverse effect on building bones after long-term use. Besides taking the recommended Vitamin D and Calcium supplements, Marie was left to her own research to find a more effective treatment plan. She knew that integrating more exercise would be a start, so she started walking for a few miles every other day. This may have helped improve her femoral neck scores from -2.2 in 2011 to -1.7 in 2013. However, lumbar spine T-scores fluctuated between 2005 and 2009 and eventually remained stagnant at the -1.8 level between 2011 and 2013. Total hip bone density measurements continued to decrease from -0.3 in 2009 to -1.2 in 2013.

As Marie’s research continued, it became clear that she needed to find a way to incorporate more weight-bearing exercise, but she feared that her chronic back pain would get in the way of her having a positive movement experience. She had only one previous experience with strength training while working with a physical therapist shortly after cancer treatment, but the exercises given did not feel meaningful or beneficial. Most of the time, she was left to do the exercises on her own without any explanation. Eventually, she could no longer afford the weekly therapy sessions and has not participated in a regular strengthening program since then.

Goals

Setting larger, more general goals to treat Osteopenia might seem straightforward when thinking about the basic objectives of stimulating bone, improving BMD test results and preventing fractures. However, there are always specific individual goals to consider and the details may vary from client to client.

With Marie’s history of breast cancer, severe depression, chronic back pain and now osteopenia, there still existed a certain amount of fear when talking about a new Pilates exercise program for the first
time. We discussed ways in which to overcome those fears and talked through the general structure of class, making sure she knew nothing would be forced and exercises could be avoided if any joint pain or discomfort occurred. Strength would be challenged in a safe way, and we would make sure to work on core strength and proprioception to support the spine and prevent falls. Considering her previous experience with physical therapy, it was also extremely important for Marie to understand the mechanics and purpose of each exercise. She wanted to, of course, improve her overall bone density scores, but also hoped that Pilates would allow her to take more control of her body. Whether inside or outside of class, she wanted to move with a little more ease and a little less pain.

Affordability was also a key factor in keeping exercise a weekly priority. For Marie, it made more sense to start a Pilates program that would suit her budget and her goals, so we decided to work on a program based on mostly Mat and some Auxiliary work that could be done with a limited amount of space and equipment. Since private or even group Pilates sessions on the equipment tend to be less affordable than mat classes, she thought this would be a more accessible way to exercise and make it a habit.

Although our sessions would focus on exercises specifically for Osteopenia and fitting Marie’s goals, she suggested we open our sessions to three of her friends in a small semi-private group setting. All participants are retired, over 60 years old, and were also looking for a more affordable way to stay strong, increase mobility and relieve back pain. Although Marie would receive some modifications for certain contraindicated exercises, the entire group would be able to benefit from these modifications and learn what works best for their bodies. It would also increase awareness around the risks of Osteopenia and hopefully encourage the others to have their own DXA scans done, as well as share information about the important correlation between healthy bones and exercise.

**Postural Assessment**

A brief postural analysis was done with Marie before the first small group session took place. Marie is 5’2” with a relatively small frame. Alignment was assessed in both sagittal and coronal planes and
did not reveal any major postural deviations. Minor imbalances included a slight forward head, a higher left shoulder, and slight pronation in the feet.
**Bone-building with the BASI Block System**

The first day of class was used mostly for setting a foundation for the group, on which to learn and grow from. We talked about the history of Pilates and what it means to engage in a mind-body-spirit exercise. We talked about how to find and maintain a neutral spine and a neutral pelvis, how to find our own imbalances, why postural muscles are important and how to get feedback from our bodies. We also practiced deep inhaling and exhaling, using the recommended intercostal breathing that helps maintain a constant inward pull of the abdominal wall while performing Pilates exercises (Isacowitz 11). Range of motion was discussed, especially in relation to flexibility, strength, and functionality. Focus and flow was encouraged, as well as communication and questions if there was any confusion about the exercises. All group participants were aware of Marie’s Osteopenia and understood that modifications given were Osteopenia-safe.

The following exercises were used to build weekly sessions that catered to Marie’s needs and goals. She focused on maintaining a neutral or extended spine with only small ranges of rotation and lateral flexion. Where spinal flexion was an option for the non-osteoporotic participants, the original version of the exercises could be executed. Select Stretch and Auxiliary exercises from the comprehensive BASI Block System were included to integrate available props and supplement the mat exercises throughout the program (*).

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**BASI Block: Foundation**

*Fundamental*

- (Roll-down omitted/replaced with breathing exercises and standing stretches to warm and prepare the body)
- Pelvic Curl
- Spine Twist Supine (Mod: small range of rotation, sometimes with feet kept on floor)
- Chest Lift (Mod: overall ball placed under scapula to move from extension to neutral)
- Leg Lifts/Changes
- Leg Circles
- Rest Position

**BASI Block: Abdominal Work**

**Fundamental**
- Hundred Prep (Mod: without chest lift, sometimes adding double leg extension as arms lower)

**Intermediate**
- Hundred (Mod: without chest lift with legs either in tabletop position or straight legs lowered to appropriate height)
- Double Leg Stretch (Mod: without chest lift)
- Single Leg Stretch (Mod: without chest lift, sometimes adding abdominal resistance by interlacing fingers and pressing palms against thigh of bent leg)
- Hamstring Pull 1 (Mod: without chest lift)

**Advanced**
- Hamstring Pull 2 (Mod: without chest lift)

**BASI Block: Spinal Articulation**

**Fundamental**
- Spine Stretch (Mod: neutral spine with slight hip hinge forward and no roll down)

* **BASI Block: Stretches (Pole Series)**
(Pole replaced with Theraband)

**Fundamental**
- Shoulder Stretch
- Overhead Stretch

**BASI Block: Bridging**

**Intermediate**
- Front Support
- Back Support
- Shoulder Bridge Prep
- Leg Pull Front
- Leg Pull Back

**Advanced**
- Shoulder Bridge
- Push Up (Mod: without roll up)

* **BASI Block: Arm Work**

**Fundamental**
- Arms Bent (Magic Circle)
- Arms Straight (Magic Circle)
- Arms Overhead (Magic Circle)
- Single Arm Side Press (Magic Circle)
- Single Arm Bicep (Magic Circle)

* **BASI Block: Leg Work**

**Fundamental**
- Knees – Supine Series (Magic Circle)
- Ankles – Supine Series (Magic Circle)
- Ankles Bent Knees – Prone Series (Magic Circle)
- Ankles Straight Knees – Prone Series (Magic Circle)
- Hamstrings – Prone Series (Magic Circle)
- Adductor Squeeze (Magic Circle)
- Side Leg Lift – Gluteals Side Lying Series
- Forward and Lift – Gluteals Side Lying Series
- Forward with Drops – Gluteals Side Lying Series
- Adductor Lift – Gluteals Side Lying Series
- Hip Extension Bent Knee – Gluteals Kneeling Series
- Hip Abduction Bent Knee – Gluteals Kneeling Series
- Hip Extension Straight Leg – Gluteals Kneeling Series

**BASI Block: Lateral Flexion/Rotation**

*Fundamental*
- Side Lifts

*Intermediate*
- Corkscrew (Mod: kept in smaller rotation range)
- Side Kick

*Advanced*
- Side Bend (Mod: without extreme lateral flexion of thoracic spine, sometimes stopping at side plank)

**BASI Block: Back Extension**

*Fundamental*
- Back Extension
- Single Leg Kick
- *Swan Prep (Magic Circle)*

*Intermediate*
- Cat Stretch (Mod: only lumbar spine flexed during “round” part of the exercise)
- Double Leg Kick
- Swimming

Exercises were built progressively over the 10-month period of practice. Once fundamental exercises were executed correctly, intermediate and some advanced exercises were introduced. Some props were used to add a comprehensive dimension to the basic mat work, while still maintaining class flow.

The Magic Circle was used in Leg Work, Arm Work, and even in assisting with some additional stretching while in supine. The overball helped Marie execute the chest lift position from extension to
neutral. The therabands assisted in the shoulder stretches and additional stretching of the hamstrings. Other exercises were integrated in order to emphasize balance, leg strength, resistance and mobility.

Many of the Osteopenia-safe exercises were inspired by a workshop I attended shortly after starting Marie’s sessions. Teresa Maldonado Marchok, leader of BASI’s “Bonesmart: Pilates for Osteoporosis” workshop that took place in Livermore, CA, provided helpful insight for developing an appropriate exercise program. She suggested suitable modifications for exercises such as Single Leg Stretch (interlacing fingers and resisting against the thigh of the bent leg with palms) and Cat Stretch (focusing on the curving of just the lumbar spine during the “round” spine), just to name a couple. She also demonstrated ways to use the Theraband in the following ways: to strengthen arms while standing and focusing on a neutral spine and pelvis; to add glute resistance by looping the band around the thighs during side lying exercises; to increase ankle and foot mobility by sequentially articulating the foot over a stretched band in a supine position; and to add resistance and stretch to basic hamstring stretches. Lastly, she introduced ways to add force and stress the bones in order to help build bone density. These exercises included jumping, stomping, and even adding heel drops in some bridging positions.

The above modifications and variations in conjunction with the BASI Block System helped tremendously in creating an effective exercise treatment to match Marie’s goals, maintain the integrity of the exercises and build strength in a safe, meaningful way.

CONCLUSION

Several goals were successfully accomplished through the exercise treatment for Marie’s Osteopenia. After 10 months of Pilates training between once and twice a week, Marie returned to the doctor for an updated DXA test and found that her bone mineral density T-scores improved in all three categories. Since the last test before starting Pilates, Marie’s lumbar spine T-score increased from -1.8 to -1.7, her femoral neck score increased from -1.7 to -1.4 and her total hip score increased from -1.2 to -1.0.
Although the increase in scores may seem minor, this was the first time in years Marie saw a steady improvement in all areas measured.

Besides reaching higher BMD scores, Marie felt a noticeable improvement in her core stability. She had gained strength in supporting her spine, which was already decreasing the amount of pain previously felt in her lower back. By the second half of our Pilates program, she was no longer “throwing out” her back or having to stay in bed for days because of it. She also discovered a new sense of body awareness, which she has been able to apply to many of her daily activities. She now pays close attention to her posture and practices positive, functional movement patterns learned in class. The group outcomes were just as successful. The other three participants felt that they developed a deeper connection with their bodies, and understood how to move more efficiently with less pain. They also appreciated the opportunity to learn more about bone strength and the risks involved in living with Osteopenia or Osteoporosis.

Getting, feeling and living stronger is a process, and we often must remind ourselves that this process is a continuous one. Despite our age, physical limitations, or previous experiences, there are ways to help improve our strength and overall health. Through Marie’s experiences and struggles with illness and recovery, she came to learn some very important lessons: 1) take a comprehensive approach to your health, do your own research and be your own advocate when it comes to taking care of your body; and 2) stay proactive in improving your exercise and health habits – it will help you feel stronger, happier, and may even prevent future injury or illness.

“Through Contrology you first purposefully acquire complete control of your own body and then through proper repetition of its exercises you gradually and progressively acquire that natural rhythm and coordination associated with all your subconscious activities.” (Pilates 18)
Works Cited


