Yoga & Pilates for Neurorehabilitation: More than Just Exercise

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Objectives

• Gain an understanding of the history and evolution of Yoga and Pilates.
• Describe the principles of Yoga and Pilates and their applications.
• Understand the benefits of Yoga and Pilates specifically in the rehabilitation setting.
• Enhance functional outcomes by utilizing Yoga and Pilates principles for patients presenting with symptoms such as, gait-, and/or balance disorders.
• Experience 2 Yoga and Pilates exercises with modifications.
• Yoga and Pilates techniques can address a wide range of challenges seen in the patient population with neuro-muscular disease processes and diagnoses involving the neuro-muscular system, for example: Parkinson’s disease (PD), Stroke (CVA), Multiple Sclerosis (MS), Traumatic Brain Injury (TBI) and Acquired Brain Injury (ABI).
• A **Traumatic Brain Injury** (TBI) is an injury to the brain caused by an external force after birth. Common causes of a traumatic brain injury include gunshot wounds, motor vehicle crashes, assaults, or falling and striking your head.

• An **Acquired Brain Injury** (ABI) includes all types of brain injuries for instance brain injuries caused after birth, by cerebral vascular accidents (commonly known as stroke), loss of oxygen to the brain (hypoxic brain injury) and brain cancer.

Table 1
Common Impairments Encountered in Rehabilitation for People with Post-Acute Neurologic Disorders
Source: Martin and Kessler (2007); Johansson, Bjuhr and Ronnback (2012)

TBI=traumatic brain injury, CVA=cardiovascular accident , PD=Parkinson’s Disease, MS=multiple sclerosis

<table>
<thead>
<tr>
<th>Impairment</th>
<th>TBI</th>
<th>CVA</th>
<th>PD</th>
<th>MS</th>
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<td>Respiration/ fatigue</td>
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<td>Balance/ coordination</td>
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<td>Muscle weakness</td>
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<td>Rigidity/ spasticity</td>
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<td>Pain</td>
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So...what is yoga?
• Yoga is a practice of breathing exercises and poses that are meant to quiet the mind.

• Meditation is often an integral part of yoga practice.

• Iyengar himself said of yoga:
  • “Practice and detachment are the means to still the movements of consciousness”
What does the research on yoga and meditation tell us about their effectiveness?
• Anecdotes and hype abound about the ability of yoga to not only improve flexibility and strength, but also to address problems like difficulties with sleep, body weight, sexual satisfaction, or will power.

• However, rigorous studies of yoga’s effects on the general population are few.
• William Broad, a science writer for the New York Times and a practicing yogi himself, conducted a comprehensive review of the research on yoga in 2012.

• He found claims of yoga as a path to physical fitness (that is, physical strength and endurance) were unsubstantiated by rigorous research.

• On the other hand, he also found good evidence that yoga can improve mood through its ability to increase levels of the neurotransmitter GABA.

• GABA (gamma-aminobutyric acid) promotes relaxation and reduces anxiety; low levels of GABA are associated with depression.
And what is yoga’s effect on people with neurologic disorders?

Lynton et al. found very limited research on yoga’s effectiveness for people with a CVA.

However, they did find some evidence that yoga improved outcomes related to CVA rehab, such as auditory and visual reaction time, strategic planning, and fine motor coordination.

Which Brings Us to Meditation
• Meditation is “focusing one's mind for a period of time, in silence or with the aid of chanting, for religious or spiritual purposes or as a method of relaxation”
  (https://en.oxforddictionaries.com/definition/meditate)

• Others would say it’s “a precise technique for resting the mind and attaining a state of consciousness that is totally different from the normal waking state.”
  (https://yogainternational.com/article/view/the-real-meaning-of-meditation)
Mindfulness-Based Stress Reduction (MBSR) is a particular type of meditation that has recently been the subject of high-quality scientific research.

MBSR is a highly structured 3-part program that includes meditation, simple yoga poses, and body scanning.
MBSR was developed by Jon Kabat-Zinn in the 1970s.
Kabat-Zinn trained as a molecular biologist at MIT, but also studied meditation and Buddhism.
• In the last few years, MBSR has received a lot of attention in the media and has been subjected to research, some based on random assignment of study participants.

• Moreover, some studies of MBSR effectiveness have focused on people with neurologic disorders.
• Johansson et al. found that MBSR reduced fatigue and increased information processing speed for people with stroke or TBI.

• Azulay et al. found that MBSR improved *self-efficacy* for managing emotional and cognitive symptoms and for problem-solving, and increased life satisfaction among people with mild TBI and post-concussive symptoms.
Finally, Eyre et al. (2016) conducted a study on 29 older adults who were concerned about their memories failing and who, when tested, had mild cognitive impairment. Half of the adults was randomly assigned to the 12-week study intervention (an hour per week of yoga and 15 minutes per day of meditation) or to a group who received a brain training program for the same duration.
Following the intervention, both groups improved in their cognitive test scores. But those practicing yoga and meditation also were:
- Less likely to be depressed
- Had better visuo-spatial memory (important for balance)
- Had increased brain communication across areas related to attention control.

Eyre, Harris, Bianca Acevedo, Hongyou Yang, et al. (2016). Changes in Neural Connectivity and Memory Following a Yoga Intervention for Older Adults: A Pilot Study. *Journal of Alzheimer’s Disease*, vol. 52, pp. 673-684.

So...who wouldn’t like to try some yoga?

- The breathing exercise (or pranayama) is called alternate nostril breathing (or nadi shodhana).
- The pose (or asana) is called cat-cow (or bidalasana-marjaryasana).
Inhale Retention

• Sit in a comfortable cross-legged position on the floor (hips elevated), or in a chair with feet flat on the floor about hip-width distance apart

• Place hands in the lap
• Sit with good posture
  • Head facing forward
  • Chin tucked in slightly
  • Spine long
  • Shoulder blades pulled down and back lightly
  • Shoulders aligned over pelvis
• Close the eyes, or soften the gaze on a nonmoving object ahead of you
• Breathe in for as long as is comfortable without strain
• Hold the breath for as long as comfortable without strain
• Exhale slowly
• Notice how the breath feels in the body. Can you feel your ribs expand and contract? Does the air on the inhale feel cooler than the air on the exhale? Are there places in the body where the breath feels “stuck?” Places where it moves more freely?
• Notice how your body feels. Do you feel the touch of clothing on your skin? Are there parts of your body that feel uncomfortable sitting? Are there parts of your body that feel more at ease?
• Notice what you hear or smell.
• Notice what you see behind closed eyes, or in the line of your soft gaze.
• Finally, notice what your mind is doing.

• But just notice. **Don’t engage in commentary, or investigation, or judgment.**

• If you notice you are engaging your mind in this way, or if you notice your mind is wandering (planning, ruminating, or complaining), simply return your attention to your breath and body, without scolding yourself.
Alternate Nostril Breathing

• Builds on this inhale-hold-exhale practice
• It adds a mudra (a hand gesture) that facilitates inhaling in one nostril and exhaling through the other, then reversing
• To start, use the right ring finger to close off the left nostril on the inhale, use the thumb and ring finger to close off both nostrils on the retention, and use the thumb to close off the right nostril on the exhale

• Then reverse by beginning with the right thumb closing off the right nostril on an inhale and ending with the ring finger closing off the left nostril on the exhale.
• Practice the observation of the body and mind described for the inhale retention pranayama
• That’s one full cycle of nadi shodhana
• This practice is believed to oxygenate and balance the right and left sides of the body and brain, as well as calming the nervous system
Practicing Yoga

Bidalasana
• This asana works the trunk (or core) muscles by moving the spine through flexion, contracting the abdominals (cat), and extension, contracting the paraspinals on the back (cow).

• Place the person in this picture in a chair, and the same movements can be made from a seated position, using arm rests for leverage.
• Start in a neutral position of good posture
• On an inhale, sink into cow position (or if seated, draw the shoulder blades together and back) and hold for a few seconds
• On an exhale, round up into cat (or if seated, round the shoulders forward and hollow out the belly) and hold for a few seconds
• Bidalasana is believed to enhance the functions of abdominal organs, and calm the mind by relieving tension and stress in the body.
• In conclusion, while the effects of yoga on physical fitness have not been upheld by the most rigorous studies, there is good evidence that yoga and meditation improve some aspects of emotional and cognitive function.

• Furthermore, if trained by an experienced yoga teacher, basic yoga poses are unlikely to have any negative effects and can be practiced throughout the life span.
Benefits of Pilates exercises

• In the United states and Europe, Pilates has become a target of interest as a useful exercise.
• Pilates exercises were developed as an exercise method to relax and strengthen the body.
• Most of the studies on Pilates training programs have focused on orthopedic remedial exercise or balance improvement in patients with low back pain or the elderly.
• Few studies have investigated the effects of Pilates in patients with neurological conditions.
The Pilates method, developed over a 60-year period, is a system of therapeutic exercises designed to:

- *Stretch*, *strengthen* and *balance* the whole body with an emphasis on the breath, mind, alignment and coordinated, flowing movements.

http://physical-therapy.adanceweb.com/Features/Articles/Incorporoting-Pilates-into-Practice.aspx, M.Decker, September 12, 2013
Pilates based physical therapy is an approach to healing, grounded in the moving body using the therapeutic movements and techniques of classical Pilates as well as traditional physical therapy interventions.

http://physical-therapy.adanceweb.com/Features/Articles/Incorporoting-Pilates-into-Practice.aspx, M.Decker, September 12, 2013
• Pilates has taken on many forms;
  • Fitness Pilates
  • Clinical Pilates
• Pilates himself indicated that his method was meant to make us responsible and in control of our own bodies and our health;
• Pilates individualized each program for each client.
Joseph Pilates

- Born in Dusseldorf, Germany in 1880;
- Sickly child;
- 1912 moved to England: boxer, circus performer, self-defense trainer;
- WWI – enemy alien, interned with other Germans;
- Became a nurse and started training other internees in physical fitness;
- 1926 emigrated to the U.S.

http://www.jillianhessel.com/pilates_biology.html
8 Principles

- Relaxation
- Concentration
- Control
- Centering
- Fluidity
- Precision
- Breathing
- Stamina
Control

- Pilates program is built around the concept of muscle control;
- No sloppy movements;
- No movement performed just for the sake of performing or “getting through” an exercise;
- Each exercise must be performed with the utmost control to avoid injury and produce positive results.
Centering

• Powerhouse of the body are the abdominal, low back and gluteal musculature;
• Pilates exercises initiate from the powerhouse and flow outward to the extremities;
• Physical energy is exerted from the center to coordinate the movements.
Precision

• Every movement in the Pilates method has a purpose;
• Every instruction is vitally important to the success of the whole;
• Concentrate on right movements each time when exercising or it will be performed improperly.
The focus is on muscles which control the lumbar and lumbosacral joints, such as:
- Multifidus
- Transversus abdominus
- Pelvic floor
- Part of the internal oblique.
Transversus Abdominus

- Traditional performance tests like the sit-up provides indications of the strength and endurance of the entire abdominal muscle group but does not indicate the specific function of the transversus abdominus.
Multifidus muscle

- Consists of a number of fleshy and tendinous fasciculi, which fill up the groove on either side of the spinous processes of the vertebrae from sacrum to axis.
- Stabilizes vertebrae in local movements of the vertebral column
Multifidus and Transversus Abdominis

- Both have primary roles that do not include the production of motion.
- Co-contraction stabilizes the spine.
• Lying on back with knees bent:
  1. Breathing (hands on lower part of rib cage);
  2. Articulation and release (tighten buttocks and lift);
  3. Hip release (let bent knee fall to the side);
  4. Leg slides (draw heel towards buttock, and extend).
Pilates Mat Exercises

- “Hundred”

- “Roll up”
• Pilates exercise with modifications in intensity:
  – Bridging;
  – Bridging with leg lift.
Arm chair Pilates exercises

1) Spine Twist

Sit near the front of your chair, spine and pelvis as neutral as you can, feet flat on the floor.

Cross your arms in front of you. Breathe in. Breathe out as you rotate your upper body to one side, contracting your abdominals. Breathe in to stay; breathe out to return to center. Repeat other side. Repeat 3 times on each side.

Repeat the exercise, this time placing your left hand on your left shoulder and your right hand on your right shoulder.

M. Merrithew. The Journal on Active Aging • July August 2005
http://www.merrithew.com/docs/pdfs/4h-sp_armchairpilates.pdf?sfvrsn=0
2) Mermaid

- Sit near the front of your chair, spine and pelvis as neutral as you can, feet flat on the floor.
- Breathe in as you reach your right arm to the ceiling. Breathe out as you lean to the left. Breathe in to return; breathe out to lower arm. Repeat on the other side. Repeat sequence 3 times.

M. Merrithew. *The Journal on Active Aging* • July August 2005
http://www.merrithew.com/docs/pdfs/4h-sp_armchairpilates.pdf?sfvrsn=0
Research Article 1

- Research on *The effects of Pilates training on flexibility and body composition.*

- An observational prospective study.
- 47 adult participants in a Pilates program of 1 hour a week, for 2 months.

• No statistical changes in truncal lean body mass or self-assessment of health.
• Flexibility improved significantly.
• Less intense Pilates exercise regime compared to 10 PT sessions had the same results in improved flexibility.

• Systemic review to investigate the effect of Pilates exercises on *Balance and falls* in older adults.

• Randomized and controlled clinical trials were searched.

• High-quality studies were lacking.

• 2 hours or more proved to be beneficial for improving balance.

• Limited data on the impact of Pilates exercise on falls.

Research article 3

Study to analyze the effects of Pilates exercise on static and dynamic balance in chronic stroke patients.

• 8 weeks, 3 x a week, mat based Pilates exercises.
• Significant improvement of Static and Dynamic balance.

To evaluate effects of a Pilates intervention on balance and function in community-dwelling older (aged >60y) adults.

- Randomized crossover study design lasting 16 weeks.
- Participants were allocated to either 5 weeks of a group Pilates training intervention or 5 weeks of usual activity (control).
• Static and dynamic balance measures and leg strength were recorded.
• Static and dynamic balance significantly improved during the study and from pre- to post-Pilates.

The purpose of this study was to investigate the effects of an 8-week program of Pilates exercise on gait in chronic hemiplegia patients.

- 3 x a week, 60 minutes of mat exercises.
- Conclusion: The 8-week program of Pilates exercise had a positive influence on improving the gait ability of poststroke patients in particular gait speed. The intervention could be applied to post-stroke patients with various levels of physical disability by adjusting the intensity of exercise.


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Conclusion

• Pilates can be used to improve activation of trunk muscles and enhance lumbar and pelvic stability.
• Trunk muscles are needed to activate the rhythmic movement that is part of the execution of gait.
• Pilates can be used in physical therapy treatments to improve trunk stability, posture, gait, and balance often affected by stroke, TBI, MS, etc.
• Pilates exercises, one hour per session, one to three times a week for eight weeks, seems effective
• More quality studies needed.
“Physical Fitness is the first requisite of happiness”
- Joseph H. Pilates


http://www.jillianhessel.com/pilates_biography.html


M. Merrithew. The Journal on Active Aging • July August, 2005

http://www.merrithew.com/docs/pdfs/4h-sp_armchairpilates.pdf?sfvrsn=0
Adaptive yoga: http://www.mindbodysolutions.org/yoga/adapative-yoga/

http://www.matthewsanford.com/content/teaching-yoga

http://www.disabledsportsusa.org/sport/yoga/?gclid=CNGPrPKiwtECFYOPswodM4AOYw

MBRS: http://www.umassmed.edu/CFM/stress-reduction/faqs/

breathe-exhale-repeat-the benefits-of-controlled-breathing.html?_r=0

&emc=edit_hh_20161209&nl=well&nl_art=5&nlid=28621515&ref=headline&te=1

How to meditate (NYT): http://www.nytimes.com/well/guides/how-to-meditate?em_pos=large&emc=edit_hh_20160909&nl=well&nlid=28621515&ref=headline&te=1

http://www.nytimes.com/column/meditation-for-real-life?em_pos=large&emc=edit_hh_20161130&nl=well&nlid=28621515&ref=headline&te=1
Questions?

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