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The Therapeutic Use of Yoga to Prevent Falls and Reduce the Risk of Falling in Older Adults

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Physical Therapy.com
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Learning Outcomes

- Define the practice of yoga.
- Identify at least three specific pathologies that would benefit from a yoga-based intervention.
- Describe at least two benefits of yoga for the prevention of falls in older adults.
- Identify at least two lower extremity muscles that, when weak, are most related to falls in older adults.
- Develop a plan of care incorporating at least four yoga asana postures that target muscles associated with falls in older adults.
- Develop a plan of care using modify traditional yoga asana (postures) for older adults with balance deficits.
Associate Professor of Physical Therapy
Quinnipiac University

Certified Yoga Teacher (200 hour)
Ardent Yoga Practitioner!!

YOGA
Definition of Yoga

Yoke ➔ Joining together
1. Body, mind and spirit
2. Individual Spirit with the Universal Spirit (Brahman)
   - More than a physical exercise

What Yoga is NOT

- A religion
- A cult
- Exclusionary: Yoga can be for anybody and everybody, it's all what you make of it.
History of Yoga

- Can be traced back as early as 3,000 BC
- Vedic Age: 1500 BC
- Vedanta period: “Veda’s End”

Literature of Yoga

- Vedanta: Upanishads & Bhagavad Gita
- 200 AD: Patanjali ➔ Yogasutras
- The advent of the yogasutras defines the beginning of The Classical Age in India ➔ Dualism
The Eight Fold Path of Patanjali

- Yamas (restraints, ethical practices)
- Niyamas (observances, daily practices)
- Asana (physical posture)
- Pranayama (control of breath)
- Pratyahara (sense control)
- Dharana (Concentration)
- Dhyana (Meditation)
- Samadhi (Ecstasy)

History of Yoga

- Finally, the Tantric era arose approximately two centuries after the Yogasutras
- Probably occurred from 500 – 1300 AD
- Different from the Classical Age
- More philosophical changes ➔ Radical Non-dualism
Hatha Yoga

- Modern Hatha yoga arose from the Tantric age
- It is the root foundation of most forms of Yoga practiced in the West
- Hatha yoga is a non-dualistic path, deeply rooted in the physical aspect of yoga, known as ASANA
- The word Hatha means “force” or “forceful”

Types of Yoga

- Jivamukti
- Ashtanga
- Iyengar
- Viniyoga
- Sivananda
- Integral
- Bikram
- Kripalu
- Kundalini
Typical Western Yoga Class

- Centering: Allows the mind to settle and clear
- Pranayama: “Restraint” of the breath (4th limb)
- Asana: Physical practice (3rd limb)
- Meditation: Dyana (7th limb)
- Savasana: Also part of the 7th limb, often deeper

QUESTIONS??

Creative use of Props...
Current Research Related to Therapeutic Yoga

- Low Back Pain
- Anxiety and Depression
- Gait, Balance and Prevention of Falling

Yoga for LBP: Galatino (2004)

- 22 participants aged 30 – 65 with Chronic LBP
- 2 Groups: Yoga & Control
- Yoga: One hour, 2X per week X six weeks
- No post-tests reached statistical significance
- Trends: Improved flexibility (sit & reach), improved balance (functional reach), decreased disability (Oswestry)
Yoga for LBP: Williams (2005)

- 44 self-referred subjects
- 2 groups: Yoga & Control
- Yoga 1.5 hours, 1X per week X 16 weeks
- Yoga participants “encouraged” to perform additional asana 5X per week X 30 min
- Yoga group: Reduced use of pain meds, improved function (PDI & PPI), Improved spinal ROM (not SSD)

Yoga for LBP: Sherman (2005)

- 3 groups: Yoga, traditional exercise, exercise pamphlet
- 101 adults with chronic LBP
- Yoga: 75 minutes, 1X per week X 12 weeks
- “Traditional Exercise” : Designed by a PT but delivered in a group setting by a non-PT
- Exercise pamphlet
- Reduction in LBP among yoga and exercise participants but not “pamphlet” group
- “Yoga is more effective than self-care book”
Yoga for LBP: Sherman (2011)

- 3 groups: Yoga, conventional stretching, exercise pamphlet
- 228 adults with chronic LBP; mean age of 50
- Yoga: 75 minutes, 1X per week X 12 weeks
- Stretching Exercises: Adapted from previous work; led by a PT
- Exercise pamphlet
- Yoga and/or “stretching” are reasonable treatment options for LBP
- Yoga was more effective than an exercise pamphlet but not superior to stretching


- Yoga for Low back Pain: A systematic Review
- Included 8 articles for a total of approximately 1000 subjects with mean age ranging from 44 – 48
- The authors noted that most individual trials were small
- There is a lack of heterogeneity of yoga interventions
- Even so, evidence exists that yoga reduces pain and disability in people with chronic LBP.
Yoga for Anxiety & Depression: Michalsen (2005)

- 16 women aged 38 with self-reported emotional distress
- 2 groups: Yoga & Control
- Yoga, 90 minutes, 2X per week X 3 months
- Reduction in perceived stress, State & Trait Anxiety and Fatigue
- Improved feelings of well being
- Salivary cortisol levels decreased after yoga


- 28 Volunteers aged 18 – 29
- Pre-screened for mild levels of depression
- 1 Group
- Yoga 1 hour, 2X per week X 5 weeks
- Yoga group: Decrease in feelings of depression & anxiety (Beck, State & Trait)
Yoga for Anxiety and Depression
Pilkington (2005)

- Meta-Analysis, ultimately used only five studies
- Found a trend toward reduction of symptoms of depression across all studies.
- Must interpret with caution as all studies used different methods of randomization and inclusion/exclusion criteria.

Yoga for Anxiety and Depression
Javnbakht et al, 2009

- 2 Groups: Yoga (N = 34); Wait list (N = 31); all female, avg. age 31
- Yoga 90 min, 2X per week X 8 weeks
- Yoga group: Decrease in feelings of depression & anxiety (Beck, State & Trait)
- The authors used a sample of convenience
Why use Yoga for the prevention of Falling?

Falls and Prevention of Falling

- One third of all community dwelling older adults fall at least one time per year.
- Falls represent the leading cause of deaths by injury
- Risk of fall increases with each subsequent fall
Falls and Prevention of Falling

- Risk factors: arthritis, symptoms of depression, orthostasis, impaired cognition, impaired balance and gait, decreased muscle strength and polypharmacy.

- Tinetti suggests that reduction of one risk factor can reduce overall fall risk.

Reducing the Risk of Falling: General Guidelines

- Reduce the Number of prescription medications
- Improve strength and balance
- Improve measures of gait
- Compel at risk seniors to participate in group-based therapeutic exercise.
Reducing the Risk of Falling: Specific Activities

- Increase the strength of the knee extensors, dorsi-flexors and plantar-flexors
- Eccentric activity
- Increase the ROM of hip extension

Why Use Yoga to Reduce the Risk of Falling?

- A class can be designed to address any specific ROM and/or strength deficits deemed appropriate for the client
- Appears to provide an added benefit of reduction in anxiety and/or depression
- Group-based exercise
- Accessible to all
- Research suggests yoga can be beneficial for many of the risk factors listed previously
Yoga to Improve Quality of Gait: (DiBenedetto, 2005)

- 19 subjects aged 62 – 83
- Yoga, 90 minutes, 2X per week X 8 weeks
- Improved hip extension ROM and average pelvic tilt
- Non significant improvement in self-selected gait speed
- Did not measure fast gait speed
- No control

Yoga to Reduce the Risk of Falling
Zettergren, Moriarty & Zabel, 2006

- 13 volunteers aged 62 - 82
- Yoga, 1 hour, 1x per week X 4 weeks
- Statistically significant increase on the Tinetti Balance and Mobility Scale
- Lack of control group
- Small sample
- Use of only one measure

Zettergren, Lubeski, Viverito (2011)

- PURPOSE: To examine the effects of a 8 week yoga program postural control, mobility, rising from the floor and gait speed in community living older adults
- A sample of convenience was recruited from two continuing care retirement communities in surrounding towns
Pre/Post-Tests: All subjects

- MMSE
- Postural control: Berg Balance Scale (BBS)
- Mobility: Time to rise from the floor to standing & Timed up and Go (TUG)
- Gait (self-selected and fast gait speed)
- Balance confidence: Activities specific balance confidence scale (ABC)

Yoga Intervention

- Intervention: Yoga, 2X per week, 90 minutes, X 8 weeks
- Yoga classes included: Seated centering and meditation, pranayama, a series of Asana (sitting in a chair, standing, seated on the floor) and Savasana
Results

- Eight research subjects, mean age (84), all female
- Eight control subjects, mean age (81), (3) men; (5) women
- No significant differences between the control group and intervention group were found on any measures at the onset of the study
- A statistically significant increase was noted in BBS scores ($t = 4.51; p \leq .003$) of the intervention group only
- A statistically significant increase in fast gait speed ($t= 2.69, p \leq .03$) of the intervention group only

Results

- TUG scores and time to arise to standing also decreased (a clinically meaningful change) although these changes were not statistically significant
- No other significant changes were noted in either the yoga group or the control group
Discussion

- MDC for BBS reported as 5.7 points. Our subjects only showed an increase of 3.5 points
- MDC for TUG is reported as 1 – 2.49 seconds. Our subjects showed a .97 second change

- MDC for fast gait speed in subjects aged 80 – 89 is reported as .18 m/s
- Our subjects showed a .17 m/s change
- MDC for arising from the floor is not known
Conclusion

- Preliminary data suggests that the intervention group experienced improvements in postural control, mobility and fast gait speed
- Yoga offers a safe and effective alternative intervention for aging adults

Limitations

- Non randomized sampling
- Small sample size
- Short duration of yoga intervention
Kelley, Aaron, Hynds, Machado & Wolff (2014)

- PURPOSE: To examine the effects of a 12 week yoga program postural control, mobility, and gait speed in community living older adults
- A sample of convenience was recruited from a local Senior Center

Pre/Post-Tests: All subjects

- MMSE
- Postural control: Mini-BESTest (MBT)
- Mobility: Timed Up and Go (TUG) and Dual task TUG
- Gait (self-selected and fast gait speed)
Yoga Intervention

- Intervention: Yoga, 2X per week, 60 minutes, X 12 weeks
- Yoga classes included: Seated centering and meditation, pranayama, a series of Asana (sitting in a chair, standing, seated on the floor) and Savasana

Results

- 13 research subjects, mean age (72), 12 females and 1 male (who always held the door 😊)
- A Statistically significant increase was noted in MBT scores (p ≤ .03), TUG scores (p ≤ .04) and Dual-task TUG (p ≤ .05)
- A statistically significant increase was noted in both self selected gait speed (p ≤ .01) and fast gait speed (p≤ .001)
Conclusion

- A longer overall duration (12 weeks) with shorter weekly duration (1 hour v. 90 min) produced better results.
- At baseline the sample may have been more functional than the previous study as all participants needed to be able to drive and walk through the parking lot to attend.
- SNOW prevented post-testing of four subjects.

Areas for Future Research

- Randomize the subjects
- Return to the use of a control group?
Yoga and Research

- Overall, group based exercise appears to be a viable and cost effective intervention to improve functional outcomes in older adults which should, logically, lead to fewer falls.
- Yoga as a group based intervention is effective
- Many yoga studies lack a specific outline of the asana practice
- More research is needed to help support the use of yoga

Linking Research and ASANA
Typical Yoga Class

- Centering/meditation
- Pranayama (breath work)
- Warm up (Depends on the Style of Yoga)
- Series of Asana to include: Standing and seated activities, inversions, forward & backward bends, twists and cool down
- Meditation (Depends on the style and length)
- Savasana

General Guidelines: Teaching Older Adults

- Start in sitting
- Centering: Body awareness
- Liberal use of props and modifications
- Two levels: One for students who CAN get onto the floor, a separate for those who CAN'T
- Spinal alignment
- Encourage rest, prevent overheating
Centering and Breathwork

- In the chair
- Diaphragm breath
- Short centering: To bring the awareness into the class
- Injuries/concerns, precautions and contraindications

Seated Warm Ups

- Neck/wrist/shoulder circles
- Ant/Post Pelvic Tilt
- Side Trunk Stretching
- Plantar- & Dorsi- Flexion
- Marching in place
- Piriformis stretch
- Standing Hip Circles & AB/AD
- Standing Toe and Heel raises
Heel & Toe Raises

- Barnett et al (2003): Increased strength of ankle DF reduced the risk of falling
- Whipple, Wolfson & Amerman (1987): Descriptive study comparing fallers to non-fallers. Found reduced strength of ankle DF and PF of fallers when compared to age matched non-fallers

Heel and Toe Raises

- Wolfson et al (1995) Retrospective review that found a strong relationship between balance, strength and gait. Subjects with decreased ankle strength (especially anterior tibialis) had decreased speed of gait
- Overall the literature shows a relationship between decreased muscle strength and increased risk of falling
The Practice: ASANA

- Begin in standing since the last warm up was in standing
- Minimize position changes to conserve energy and keep the flow of the class

TADASANA (Mountain)
TADASANA (Mountain)

- Forms the foundation for all standing poses
- Emphasize alignment, contraction of all muscles
- Begin by engaging the feet (can emphasize anterior tibialis), move superiorly, include all muscles
- Be sure to engage the core
- Safe and effective as part of the HEP

Standing Series

- Utkatasana (Chair)
- Virabhadrasana I (Warrior I)
- Virabhadrasana II (Warrior II)
- Utthita Parsvokonasana (extended side angle)
- Trikonasana (Triangle)

- Research and ASANA
Research and Quadriceps Strengthening

- Whipple, Wolfson & Amerman (1987): Reduced mean power of knee flexion and extension in fallers compared to non-fallers
- Carville, Perry et al (2007): Three groups: Healthy young, older non-fallers, older fallers. Fallers have less steadiness in eccentric quadriceps contraction. This variable distinguishes fallers from non-fallers in a lab setting

UTKATASANA (Standing Squat)
UTKATASANA (Standing Squat)

- Per Texts on Yoga: Strengthening of all or most of the muscles of the LE’s
- Kelley et al (2016; 2017; 2019): Utkatasana is an effective way to engage the quadriceps. There is not a large amount of EMG activity in other muscles including the Glut Med (2017)

VIRABHADRASANA I (Warrior I)
VIRABHADRAASANA I (Warrior I)

- Per Texts on Yoga: Strengthens quads, gluts and improves balance
- Emphasize hugging to the midline to improve balance
- Foot position is negotiable

- MVC of quadriceps approximately 50%, hamstring group approximately 30% (2013, unpublished data)
- Current theory is that the gastroc/soleus complex may anchor this pose more than the quadriceps/hamstrings
- Dropped from subsequent projects in lieu of other poses with greater output of LE muscles
VIRABHADRASANA II (Warrior II)

- Yoga Texts also suggest similar muscular activity to Warrior I (Quads, gluts, hams)
- “Hip opening” pose
- MVC of quadriceps and hamstrings is not as high as the yoga texts would suggest
- DiBenedetto (2005)
TRIKONASANA (Triangle)

- “Hip opener”
- Can modify with block or chair
- Stretches the lateral portion of the trunk
VRIKSHASANA (Tree Pose)

- A balanced yoga class will include balancing poses

- In yoga, balancing poses teach us humility and concentration, build awareness, improve core stability
Research: Unilateral Stance

- One-legged stance, Uni-pedal stance
- Vellas et al (1997): Unilateral stance times are predictors of injurious falls but not all falls **
- Michikawa et al (2009): Review of 23 studies. Concluded that one-legged stance may be a tool for predicting frailty and times are related to falls. BUT, cautioned that time used and test administration varied among studies

Research: Unilateral Stance

- Wang et al (2006): Most difficult items on the BERG are one-legged standing and tandem standing. Other items on this test may not be difficult enough for community dwelling well elderly. Using these two items alone, authors were able to discriminate between fallers and non-fallers
EMG Research: VRIKSHASANA

- Large amounts of iEMG data in experienced practitioners of the gastroc and anterior tibialis (gastroc with the highest amount)
- No significant difference in iEMG data between experienced and inexperienced practitioners
- Overall, females have more output than males in most LE muscles

ADHO MUKHA SHVANASANA
(Downward Facing Dog)
ADHO MUKHA SHVANASANA (Downward Dog Pose)

- Known as an “inversion” asana
- Benefits of inversion: Increase blood flow to the head and neck, bringing nutrients to the glands
- Opportunity to weight-bear on the UE’s.
- A cornerstone pose in Yoga
- Contraindications: Uncontrolled HTN, detached retina, status post cataract surgery

EMG shows fairly even distribution through UE and LE in this pose:
- Biceps: 20% MVC
- Triceps: 25% MVC
- Quadriceps: 40% MVC
- Hamstrings: 20% MVC
- Gastroc: Larger percent MVC in experienced practitioners
- (2010, Unpublished data)
Shalabasana (Locust Pose)


BADAKONASANA (Bound Angle)
BADAKONASANA (Bound Angle)

- Excellent hip opener
- Modify by propping knees up with blankets or pillows
- Substitute with easy cross-leg pose of this is too difficult or uncomfortable
- Promote upright posture during the position to strengthen the trunk and lengthen the spine

NAVASANA (Upward Boat)
NAVASANA (Upward Boat)

- Modify with knees bent; one foot down at a time; UE’s straight out or down by the sides
- Abdominal strengthener
- More accessible than it initially appears

SETU BANDHASANA (Bridge)
SETU BANDHASANA (Bridge)

- Chest opener
- LE strengthener
- Can emphasize the anterior tibialis by having participants lift their toes up and engage the front of the shin
- May need to support C-Spine with small towel roll
- Promote lengthening the C-Spine

PAVANAMUKTASANA (Wind Relieving Pose)
PAVANAMUKTASANA (Wind Relieving Pose)

- Massage of abdominal organs
- Improves peristaltic action in the intestines
- Lengthening of the hamstring muscles
- Can use as abdominal strengthener
- Contraindications: Recent abdominal surgery; pregnancy after the 3rd month

SHAVASANA: The Dessert of Yoga

- “Hardest Pose” - BKS Iyengar
- Comfort
- Benefits: Removes fatigue, soothes the mind, relaxes the body
- Khumar, Kaur & Kaur (1995): Shavasana alone can reduce symptoms of depression **
Take home message…

- We need more DATA!!
- Overall, the current work is promising, yoga:
  - can reduce the risk of falling
  - may improve LE strength
  - does reduce anxiety and improve symptoms of depression

- Things that haven’t been measured…….
CHAIR YOGA SEQUENCE

- The following slides are intended to provide the student with suggestions for modifying ASANA for people who have difficulty standing and/or rising from the floor.

Warm Ups

- Anterior and posterior pelvic tilt
- Side trunk stretching
- Warm up of the cervical spine (no extension)
- Gentle arm circles
- Wrist Circles
- Marching in place
- Seated Heel and Toe raises
Shoulder Stretches

- Arms overhead with elbows at 90 (stretch the triceps)
- Clasp hands behind the head
- Towel stretch
- Garudasana Arms
- Anjali mudra and reverse

Clasp Hands Behind Head
Towel stretch for shoulders
(Can also use a yoga belt or necktie)

Garudasana Arms (Eagle)
Breath work with UE stretch

Seated Tadasana: Arm position can be based on participant comfort
Modified Ardha Chandrasana (Half Moon Pose)

Seated Sun Salutation

- Sun salutations are often used in traditional classes to heat up the body, warm up the legs for standing sequences
- In sitting it can provide a way to increase respiration and warm up the body
- Get participants moving even though they will remain seated
Seated Utkatasana (Chair Pose)

Arms by the sides

- Start with the arms all the way down or, hands on the hips
- Work up to arms over head
VIRABHADRASANA I (Warrior I)

VIRABHADRASANA II (Warrior II)
Utthita Parsvakonasana
(Extended Side Angle)

Simple Twist
Ardha Matsyendrasana
(Half lord of the fishes)

Deep Twist with Anjali Mudra
(Parivrtta Utkatasana)
Succirandrasana (Eye of the Needle)

Piriformis Stretch
Runner’s Stretch
(Half Hanumanasana)

Quadriceps Stretch
Garudasana: Full pose with Chair

Pavanamuktasana (Wind Relieving)
Seated Forward Fold (Paschimotanasana)

Use of the Chair as a Prop for Standing Asana
UTKATASANA (Modified with Chair)

[Image of two people performing a yoga pose]

UTKATASANA (Modified with Chair)

[Image of two people performing a yoga pose]
ADHO Mukha Shvanasana
(Down Dog)
ADHO MUKHA SHVANASANA

ADHO MUKHA SHVANASANA (modified with bench)
Triangle (Trikonasana)

Vrksasana (Tree Pose)
Many Thanks…..

- Study participants and other “models”
- QU Motion analysis Lab & QU students

DISCUSSION/WRAP UP


• Kelley, K, Aaron, D, Hynds, K, Machado, E & Wolf, M (2014) . The Effects of a Therapeutic Yoga Program on Postural Control, Mobility and Gait Speed in Community-Dwelling Older Adults. *J of Alt and Comp Med*, 00(0):1–6DOI: 10.1089/acm.2014.0156


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