

## Yoga led by a physical therapist for individuals with Essential Tremor: An explorative pilot study

Natalie E. Vance<sup>a,\*</sup>, Elizabeth A. Ulanowski<sup>b</sup>, Megan M. Danzl<sup>b</sup>

<sup>a</sup> Cressman Rehabilitation, Norton Healthcare, Louisville, KY, USA

<sup>b</sup> Doctor of Physical Therapy Program, School of Movement and Rehabilitation Sciences, College of Health Professions, Bellarmine University, Louisville, KY, USA

### ARTICLE INFO

#### Keywords:

Yoga  
Essential Tremor  
Physical therapy

### ABSTRACT

**Purpose:** The purpose of this pilot study is to evaluate the outcomes for individuals with Essential Tremor (ET) who participate in a community-based yoga class, led by a neurologic physical therapist.

**Methods:** Six subjects with ET completed an 8-week intervention consisting of weekly 1-h yoga classes (in the Vinyasa style) guided by an instructor (200-h registered yoga teacher, physical therapist, and neurological resident).

**Results:** Five subjects demonstrated improvements on the Tremor Research Group Essential Tremor Rating Scale (mean 15.3%, range 8.3–34.7%). The mean improvement on the Fullerton Advanced Balance Scale was 10.8% (range 2.5–20%). Five subjects maintained pre-intervention anxiety levels (“very low”) while one reported increased anxiety secondary to a non-study related factor. Minimal improvements were noted in the McGill Quality of Life Questionnaire.

**Conclusion:** This pilot study offers support for further examining the benefits of integration of yoga into an exercise program for individuals with ET and specific suggestions for future research are offered. There were no adverse events with participation in yoga.

### 1. Introduction

Essential Tremor (ET) is the most common adult movement disorder, approximately 20 times more prevalent than Parkinson disease (PD) [1]. The estimated overall prevalence of ET is 0.9%, or approximately 70 million individuals worldwide [2]. The tremor, characterized as a postural or kinetic type, primarily involves the distal upper limbs. Tremor in the head, lower limbs, voice, tongue, face, and the trunk are less common. The tremor amplitude increases with time and individuals experience difficulty with writing, eating, holding objects, fine motor tasks, dressing, and speaking [3].

The role of exercise and physical therapy is traditionally focused on strength training to improve control and reduce tremor in individuals with ET [4–6] and task-specific training to improve dexterity [7]. There is less evidence exploring the role of exercise and physical therapy to address balance deficits. Neurologic physical therapists [8] commonly conduct falls risk assessments and treat balance impairments. They are prime healthcare providers to meet any balance-related needs of individuals with ET. While physical therapy is potentially beneficial [3], there is no research that speaks to the rate of referrals to physical therapy for individuals with ET. This is not surprising given both the limited physical therapy research reports in ET and that rehabilitation research examining interventions for individuals with ET is in its

infancy. Furthermore, evidence-based guidelines from groups such as the American Academy of Neurology solely focus on surgical and pharmacologic interventions [9]. There are no specific guidelines for activity to assist in managing the symptoms of ET indicating a need for preliminary pilot work in this area.

Many individuals with ET have severe psychosocial disability [3]. In some cases, tremor can increase with anxiety, stress, and in situations involving interaction with others [3]. Examination of a treatment approach that addresses factors contributing to both the physical and psychosocial disability experienced by individuals with ET, with a particular emphasis on stress reduction, is needed.

Yoga, considered to be “science of the mind” as stated in the Yoga Sutras of Patanjali, is a practice of physical postures (Asanas), meditation (Dhyana), and breath (Pranayama) [10]. Practicing yoga reduces pain, relieves tension, reduces risks of injury, improves posture, improves communication, increases energy and attention span, and enhances feelings of overall wellness and well-being [11]. Practicing the postures, deep breathing, and the stretching movements of yoga elicit a relaxation response and results in an increased awareness of the body [11]. Yoga stimulates the parasympathetic nervous system and reduces muscle tension [11]. Yoga decreases the activity of the sympathetic nervous system [11], thereby decreasing the body’s natural stress response. Patel et al. (2012) [12], reports that yoga improves walking,

\* Corresponding author. 4950 Norton Healthcare Blvd., Louisville, KY, 40241, USA.

E-mail address: [nelliott@bellarmine.edu](mailto:nelliott@bellarmine.edu) (N.E. Vance).

balance, muscle strength, cardiovascular health, blood pressure, sleep, and health-related quality of life. The role and effectiveness of yoga for individuals with ET is not previously reported in the literature.

ET usually does not reduce life expectancy [3], however, physical therapists may have an important role to play to reduce the disability associated with living with ET. Balance impairments may contribute to disability associated with ET but there is presently very little data that quantifies the effects ET has on balance let alone the therapy intervention options to improve balance. The prevalence of balance impairments in individuals with ET is unknown. While normal locomotion in individuals with ET can present with very few alterations, tandem gait is affected [13]. Furthermore, individuals with ET have less balance confidence, more falls, and a greater need for assistive devices than age-matched controls [14].

The purpose of this explorative outcomes pilot study is to evaluate the outcomes for individuals with ET who participate in a community-based yoga class, including measures of tremor, anxiety, balance, and quality of life. The implications of the pilot findings on future research considerations will be discussed. Furthermore, we will discuss the barriers and facilitators to establish a community-based group yoga program for individuals with ET along with identifying impairments that may warrant further evaluation and referral to a neurological physical therapist.

## 2. Materials and methods

An explorative pre-post outcomes design [15] was used to investigate the outcomes of yoga on impairments, activity limitations, and participation restrictions associated with ET in this pilot study. The Institutional Review Board of Bellarmine University granted ethical approval. Voluntary informed consent was obtained from all subjects.

### 2.1. Subjects

Inclusion criteria for the study were diagnosis of ET, ambulatory, and  $\geq 18$  years of age. Exclusion criteria included a diagnosis of an atypical movement disorder (e.g., ET in combination with PD), inability to follow one-step commands, inability to complete questionnaires, and severe comorbidities (e.g., active cancer, congestive heart failure).

Nine subjects diagnosed with ET initially responded to recruitment efforts (through local ET support groups, community exercise groups, and a large urban hospital rehabilitation department). One was excluded secondary to a severe comorbidity. Two additional subjects withdrew during the study (one due to a change in living situation, one due to transportation limitations). In total, six subjects completed the study (Table 1).

### 2.2. Intervention

The intervention consisted of a 1-h guided yoga class in a local yoga studio, once a week, for 8 weeks. The class instructor Dr. Natalie Vance, was a 200-h registered yoga teacher, licensed physical therapist, and neurological physical therapy resident (residency accredited by the American Board of Physical Therapy Residency and Fellowship Education).

**Table 1**  
Subject demographics.

Subject Number	Sex	Age	Duration of ET Diagnosis	Medications (for tremor)
1	F	63	40 yrs	Prozac (Fluoxetine), Ativan (Lorazepam)
2	F	75	15 yrs	Neurontin (Gabapentin)
3	F	23	13 yrs	Klonopin (Clonazepam), Topamax (Topiramate)
4	F	47	14 mos	None
5	M	25	5 mos	None
6	M	25	5 mos	None

\*F = female; M = male; yrs = years; mos = months.

The eight classes were based on the Vinyasa style of yoga. This style reflects a flow of movement that incorporates integral yoga poses of the “Journey into Power” Baptiste Institute™ methodology. This methodology includes three major practices and techniques including the physical practice (Asana), meditation (Dhyana), and inquiry (Niyama). The focus of the classes in this study included the previous two practices of the methodology.

Other components included in this study and in accordance with the Vinyasa style were the True North Alignment and the Five Pillars of the Vinyasa Yoga Practice. These pillars include Drishti (gaze), Ujjayi (breath), Bandha/Foundation (core, hands and feet), Tapas (heat), and Vinyasa (flow). The flow was demonstrated in each class through a sun salutation or Surya Namaskar, which means “to bow” or “to adore.” [16–18] Each sun salutation ended with joined-hands touched to the heart [16–18] and each was modified and performed without Upward-facing Dog (urdhvamukha shvanasana) and Downward-facing Dog (adho mukha shvanasana) in order to maintain chair variations. Each sun salutation would begin and end in Mountain Pose, also known as Tadasana, a yoga Sanskrit translation meaning “to stand as erect as a mountain” [18].

Poses were held for approximately 30 seconds. Poses were tailored for sitting or standing based on subject needs. As an example, the Mountain Pose (Tadasana), a basic standing pose [19], was adapted as a chair variation in which subjects sat at the edge of a chair in an erect position with feet firmly planted on the floor. For standing poses that challenged balance, the subjects could use upper extremity support on the chair as needed. Additional examples of standing balance poses included tree pose (Vrkasana), eagle pose (Garudasana), and warrior III (Virabhadrasana III), all of which focus on single limb stance and hip stability. The conclusion of each class included seated stretching poses with an emphasis on hip openers such as seated half pigeon (Eka Pada Rajakapotasana) prior to the final meditation.

Each class focused on utilizing different tremor reduction techniques during the yoga practice. Examples include using a block on the ground to press through the hands during seated sun salutations, pressing palms together during mountain pose and cues for the subjects to perform full extension of the fingers during each pose in order to strengthen and activate the small intrinsic muscles of the hand. Lastly, each class began and ended with a meditation component, lasting approximately 5 min each.

Breath was a key element in each class. The subjects were educated on the importance of breathing techniques, specifically Ujjayi breathing, a four-part breath studied within varying types of yoga practice. This four-part breath includes a pause at the end of each inhale and exhale resulting in a constriction at the back of the throat to develop a deep, audible breath with each movement.

### 2.3. Data collection

The study investigators, co-workers (licensed Physical Therapists), and physical therapy students enrolled in the local Doctor of Physical Therapy program administered the outcome measures. Data were collected at week one, week eight, and at a follow-up period (6 weeks post-intervention). Reflective of the World Health Organization's International Classification of Functioning, Disability, and Health domains [20], outcome measures examined impairments (tremor, anxiety), activity limitations (balance), and participation restrictions (quality of life) associated with ET. Currently, there are no minimal detectable change or minimally clinically important difference values reported for the outcome measures used in this study.

Tremor was assessed with the Tremor Research Group Essential Tremor Rating Scale (TETRAS), v.3.1, a valid and reliable rating scale for the ET population [21]. There are two portions of this rating scale: a subjective portion in which the subject reports the impact of tremor on activities of daily living (ADLs) and an objective portion which assesses the amplitude of tremor with specific movements that typically elicit a tremor (e.g., full extension of the upper extremity, finger to nose

**Table 2**  
Survey questions.

1. Did you enjoy participating in the study? If so, why?
2. If these yoga classes were offered again, what suggestions do you have for changes?
3. If this research study was conducted again, what suggestions do you have for changes?
4. Were there any barriers to participating in these yoga classes (e.g., level of difficulty, accessibility)?
5. If you would continue to participate in weekly yoga classes, what are the primary reasons for doing so?
6. Did these classes impact your daily life? If so, how?
7. As a result of this study, did you experience a decrease in your tremor? If so, please provide examples.
8. Any additional feedback or comments?
9. Rate the following statements based on the extent to which you agree:  
(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)
  - The weekly yoga classes were beneficial to my health.
  - I would recommend these classes to a friend or family member who is diagnosed with Essential Tremor.
  - Regular participation in the weekly yoga classes improved my ability to control stress.
  - I would continue these classes weekly if the time and location were accessible to me.
  - After participating in each weekly yoga class, I had more control over my tremor with daily activities.
  - As a result of participation in this study, I experienced an improvement in my anxiety level.
  - The level of difficulty was appropriate for these classes.

testing). Administration of the test in this study included the use of recommended standardized equipment and procedures and the same examiner assessed this test each time.

The Beck Anxiety Inventory (BAI), a self-report measure to assess the severity of anxiety, is both sensitive and specific when screening for an anxiety disorder [22]. Score interpretation is as follows: 0–21 very low anxiety, 22–35 moderate anxiety, 36 or greater severe anxiety.

The Fullerton Advanced Balance (FAB) Scale assesses both static and dynamic balance and is typically used with higher-functional, active older adults [23]. The FAB Scale is highly sensitive and specific to predicting fall risk [24]. This specific balance scale was chosen because it includes tandem gait, step up and over obstacle, walking with head turns, and single-limb stance. These activities are functional, correlate to fall risk, and include an assessment of the vestibular involvement with dynamic activities [24]. The maximal score is 40 and higher scores are indicative of better balance.

Each of the subjects rated quality of life with the McGill Quality of Life Questionnaire. While it is yet to be validated in ET, it crosses a broad spectrum of domains applicable to individuals with ET. This questionnaire is divided into 4 subscales (A, B, C, D). Part A is a Likert rating scale considering all aspects of life, physical, emotional, social, spiritual and financial. Part B assesses physical symptoms or physical problems. Part C assesses feelings and thoughts over the previous two days while Part D is an open-ended list in which the participant can document “things that have had the greatest effect on their quality of life over the previous 2 days.” Participants were offered the opportunity to complete Part D but there was inconsistency in completion secondary to the writing required. Part D responses were consulted to determine if there was anything affecting their quality of life in the previous 2 days that would help explain the results of the other subscales, however, Part D does not factor into the total numerical scores. This outcome measure considers the effect of existential well-being and its role as a determinant of quality of life [25]. These results provide insight into the role of tremor, stress, and anxiety in individuals' lives. This scale rates each situation pertaining to quality of life as “0” being the least desirable situation and “10” being the most desirable situation [25].

Upon completion of the study, subjects completed a survey developed by the investigators. This survey assessed each subject's perception of the study with a Likert scale format of 7 statements and 8 semi-structured, open-ended questions (Table 2).

### 3. Results

Attendance recorded for each class revealed that each subject came to at least 50% of the classes with some subjects missing only 1–2 classes during the study (mean attendance 5.33/8 classes; range 4–7). All six subjects completed immediate post-study assessments. Three subjects completed the 6-week follow-up testing (subject scheduling conflicts precluded follow-up testing for the remaining 3 subjects).

TETRAS results are presented in Figs. 1 and 2. Upon immediate completion of the study, 4/6 subjects self-reported perceptions of decreased tremor with ADLs based on the TETRAS ADL subscale (mean 6.8% improvement with a maximum improvement of 20%). From the results, 5/6 of the participants demonstrated improvement on the objective performance-based section (15.3% mean improvement with a maximum of 34.7%). At the 6-week follow-up, the 3 subjects reported a decreased perception of tremor with daily tasks compared to the immediate post-testing (22% mean improvement with a maximum improvement of 41%) and 2/3 subjects demonstrated a decreased amplitude of tremor compared to post-testing (4.4% mean improvement with a maximum of 8.3%).

Each subject demonstrated at least a 10% improvement on the FAB Scale upon completion of the intervention (mean 10.8%, range 2.5–20%) (Fig. 3). The 3 subjects who completed the follow-up testing demonstrated a continued improvement in balance compared to the post-test.

Post-intervention results of the BAI (Table 3) revealed 5/6 subjects maintained their pre-study category of anxiety at “very low.” One subject went from “moderate” to “severe” anxiety. This subject shared that this score was a result of the recent loss of a family member. At the 6-week follow-up, 3 subjects completed the BAI again and results indicated maintenance of their previous levels of anxiety (2 with “very low” and 1 with “severe”).

The McGill Quality of Life Questionnaire given to participants' pre- and post-intervention demonstrated minimal improvements. One participant trended towards improvements in 3 subscales and 2 other participants trended towards improvements within 2 out of the 3 subscales.

For the post-study survey, each subject rated either “agree” or “strongly agree” when asked to report on their experience in the class. These results indicated that each subject had a positive experience with the intervention and more perceived control over their tremor with daily activities. Verbatim responses to open-ended questions reflecting perceptions of the yoga classes are presented in Table 4.

### 4. Discussion

The purpose of this study was to explore the benefits of participation in weekly, community-based, yoga classes for individuals with ET. This pilot study revealed no adverse events associated with participation by subjects with ET in a regular yoga class led by a physical therapist and positive experiences with participation. Notable improvements included the areas of perception of tremor and balance.

There are several limitations, however, to this research. This explorative study consisted of a small sample size and a wide range of ages; therefore, the findings are difficult to generalize to all individuals with ET. We also did not assess previous subject experience with yoga which may have affected the results. The examiners and participants were not blinded to the study nor were subjects randomized. Subject recruitment was from the local ET support group, potentially contributing to a self-selection bias. Lastly, life events external to the study precluded several subjects from the follow-up data collection. This prohibited a more thorough assessment of the reversibility or maintenance of the clinical benefits post-intervention.

The value of this work lies in providing a springboard for future research with robust designs that examines the effects of yoga for individuals with ET. Specific considerations for future research design are outlined below, situated within the experiences and outcomes of this pilot work.

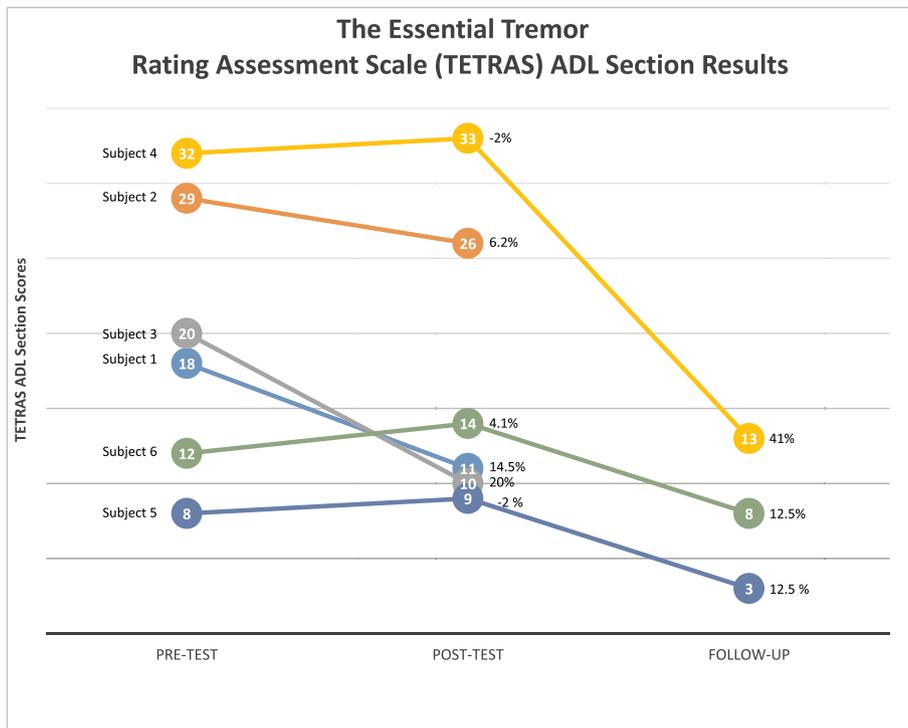


Fig. 1. Illustrates changes of raw data from pre-test to post-test and post-test to follow-up visit. Percentages indicate percentage change at each interval.

Specific to subjects and design in future studies, we suggest aiming for a larger sample size based on a power analysis. Also, ET can affect adults of any age [26]. Given the potential differences of the effects of yoga based on age, consideration of cohorting subjects with ET by age is warranted. Future studies should elucidate the effects of yoga for novices versus routine yoga participants as this variable might contribute to different results. Blinding and randomization warrant consideration in future studies to enhance design rigor. Careful considerations are needed

to establish an appropriate age and tremor-matched control group.

Our findings are consistent with previous research [14] which reveals that there are balance impairments in those that live with ET that would warrant physical therapy evaluations for these individuals. Referral of individuals with ET to a physical therapist specialized in neurological disorders for falls risk assessment and subsequent balance training warrants consideration. While the influence of a potential test-retest learning effect and improved confidence of subjects in ability to

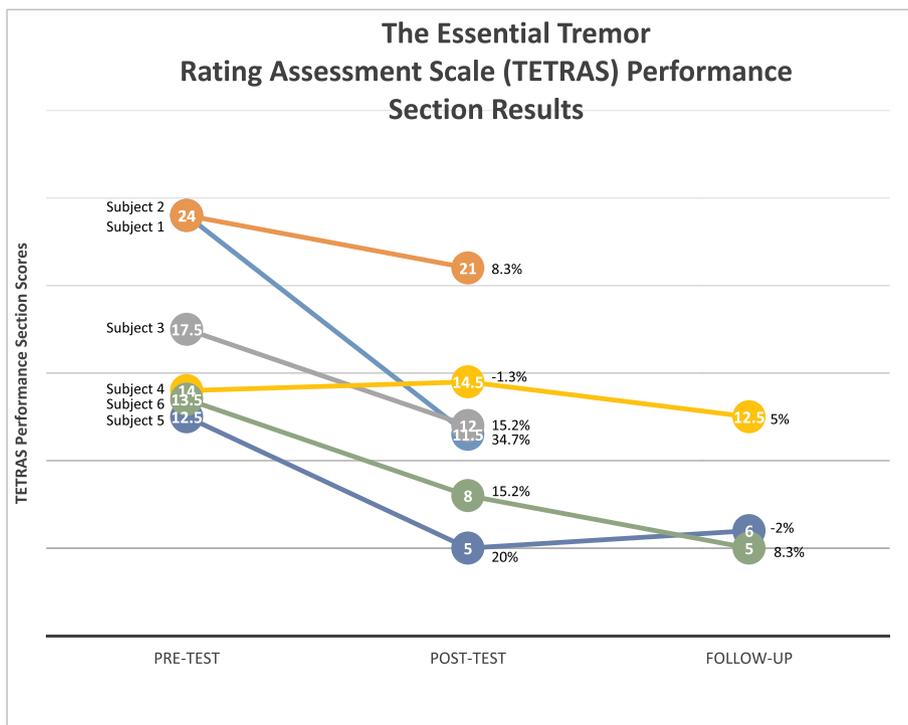


Fig. 2. Illustrates changes of raw data from pre-test to post-test and post-test to follow-up visit. Percentages indicate percentage change at each interval.

### Results of Fullerton Advanced Balance (FAB) Scale

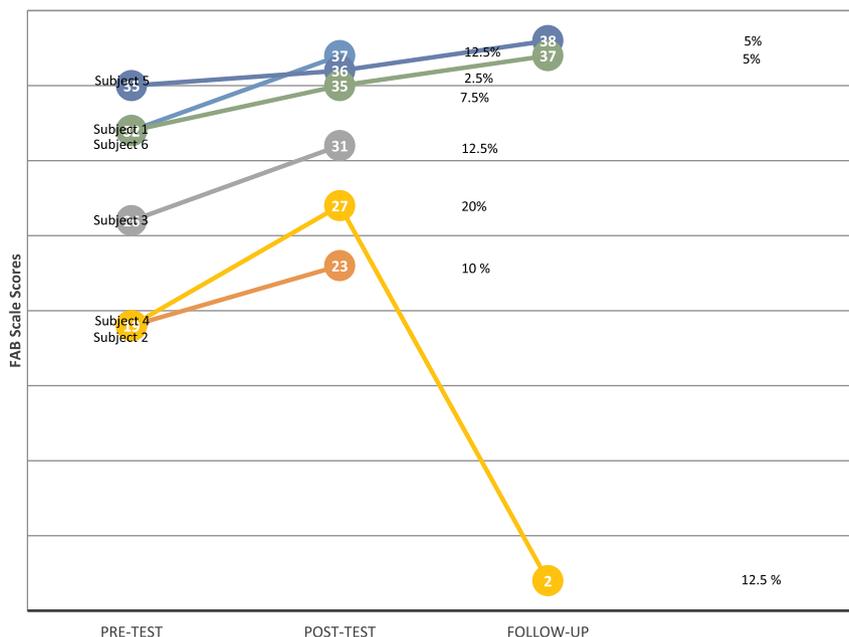


Fig. 3. Illustrates changes of raw data from pre-test to post-test and post-test to follow-up visit. Percentages indicate percentage change at each interval.

**Table 3**  
Beck anxiety inventory<sup>a</sup> (BAI) results.

Subjects	Pre-	Post-	Follow-up
1	5	5	N/A
2	14	16	N/A
3	15	13	N/A
4	28	58	42
5	10	8	3
6	11	9	10

<sup>a</sup> The BAI is a self-report measure to assess the severity of anxiety; 0–21 = very low anxiety, 22–35 = moderate anxiety, ≥ 36 = severe anxiety.

perform activities of the FAB Scale must be considered when interpreting the improvements, the preliminary findings of this pilot study indicate a need for further examination of the effects of yoga on balance in individuals with ET. The FAB Scale was easy to administer and is

**Table 4**  
Survey responses.

Questions	Subject Responses Immediately Post-Study	Subject Responses at Follow-up
Did these classes impact your daily life?	<i>They provided me with a personal stress relief and a way to reduce my tremor in a new, non-medical way. (Participant 3)</i> <i>Lower anxiety and increased confidence. (Participant 1)</i> <i>Yes, my tremors, my moods, my happiness, my attitude and my health. (Participant 4)</i> <i>Yes, I was more calm at work and at home. (Participant 5)</i> <i>These classes made my daily life better. (Participant 6)</i>	<i>Yes, my thoughts became less harder for me to explain. (Participant 4)</i>
As a result of this study, did you experience a decrease in your tremor? If so, please provide examples.	<i>Sometimes yes, helped make my hands less shaky. (Participant 5)</i> <i>I did experience a decrease in my tremor because it made me more relaxed. (Participant 6)</i>	<i>At times, my handwriting. (Participant 4)</i>
Did you enjoy participating in this study? If so, why?	<i>Yes. It helped keep me calm during the week. It also released some stress from my life. (Participant 5)</i> <i>It gave me more confidence and helped me learn that I can push myself to learn new things. (Participant 1)</i>	<i>No responses.</i>
If you would continue to participate in weekly yoga classes, what are the primary reasons for doing so?	<i>No responses.</i>	<i>I would continue these classes because it reduces my stress. (Participant 6)</i> <i>The peace and tranquility and friendship (Participant 4)</i>

recommended for future trials. If fully exploring the effects of yoga on balance specifically and dependent upon the functional level of the subjects, researchers could also consider the mini-BESTest, Berg Balance Scale, and Activities-specific Balance Confidence Scale [27,28].

Assessment of the effects of yoga on tremor is particularly needed given the activity limitations and participation restrictions associated with tremor in ET [3]. For examination of tremor, the TETRAS used in this study was easy to administer, feasible, and recommended for future work. Given the embarrassment commonly associated with tremor in ET, we also recommend use of the Essential Tremor Embarrassment Assessment (ETEA) [29], which measures tremor-related embarrassment, in future studies examining the effects of yoga.

The minimal improvements depicted with the McGill QoL questionnaire were potentially due to factors external to the study or due to the general QoL measure used. Given the effects of tremor on QoL in individuals with ET [30], continued examination of the effect of yoga on QoL is needed. We recommend that future studies use the Quality of Life

in Essential Tremor (QUEST) Questionnaire [31], licensed and owned by the International Parkinson and Movement Disorder Society. Examination and determination of the optimal frequency and duration of the yoga intervention will be particularly important in exploring QoL.

Anxiety may also be worth examining in future studies. To assess anxiety, a longer intervention period and/or more frequent sessions is recommended as 1 time per week for 8 weeks is a potentially insufficient dose to see changes in this area. Five of the six subjects in this pilot study had low levels of anxiety. Another consideration for future work is to purposely recruit individuals with ET who report having higher levels of anxiety as is consistent with ET [32].

For those interested in creating community-based group yoga classes for individuals with ET, there are facilitators and barriers that were identified through this work that could inform program development. A primary facilitator was the physical therapist as class instructor. A yoga certified physical therapist enabled a deeper understanding of falls risk assessment, balance impairments, and effectively modifying each class to address impairments in individuals with ET. If a yoga certified physical therapist is not available, we encourage certified yoga instructors to consult and collaborate with a neurologic physical therapist to better tailor the classes to individuals with ET. Other factors that allowed for the success of the program were the donation of space from the yoga studio, physical therapy student volunteers, and the local support group that aided in recruitment. Potential barriers include transportation for subjects, accessibility (e.g., location, time of class), and level of difficulty of the yoga classes.

Exercise and physical therapy play an important role in utilizing strength and task-specific training to address deficits associated with ET [4–7]. Adding different forms of exercise to the therapeutic armamentarium of physical therapists can provide a more comprehensive approach to enhance management of this progressive disease. Interest from members of the ET community as well as the interest of therapists searching for alternative exercise programs for individuals with ET were the impetuses for this pilot study. While further research is needed to robustly examine the effects of yoga on impairments, activity limitations, and participation restrictions in individuals with ET, this exploratory work can serve as a catalyst for reflection on complementary therapy options for managing this progressive disease through exercise.

## Conflicts of interest

None.

## Acknowledgements

This research was supported by Bellarmine University and Norton Healthcare. We thank 502 Power Yoga located in Louisville, Kentucky for providing the space and equipment to conduct this study. We also thank our colleagues who assisted with data collection and specifically Dr. Gina Pariser who consulted on data analysis.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ctcp.2018.10.010>.

## References

- J. Benito-Leon, Essential tremor: a neurodegenerative disease? *Tremor. Other. Hyperkinet. Mov. (N Y)* 4 (2014) 252, <https://doi.org/10.7916/D8765CGO>.
- E.D. Louis, J.J. Ferreira, How common is the most common adult movement disorder? Update on the worldwide prevalence of essential tremor, *Mov. Disord.* 25 (5) (2010) 534–541, <https://doi.org/10.1002/mds.22838>.
- P.K. Pal, Guidelines for management of essential tremor, *Ann. Indian Acad. Neurol.* 14 (Suppl 1) (2011) S25–S28.
- M. Bilodeau, D.A. Keen, P.J. Sweeney, R.W. Shields, R.M. Enoka, Strength training can improve steadiness in persons with essential tremor, *Muscle Nerve* 23 (5) (2000) 771–778.
- J.J. Kavanagh, J. Wedderburn-Bishop, J.W. Keogh, Resistance training reduces force tremor and improves manual dexterity in older individuals with essential tremor, *J. Mot. Behav.* 48 (1) (2016) 20–30, <https://doi.org/10.1080/00222895.2015.1028583>.
- G. Sequeira, J.W. Keogh, J.J. Kavanagh, Resistance training can improve fine manual dexterity in essential tremor patients: a preliminary study, *Arch. Phys. Med. Rehabil.* 93 (8) (2012) 1466–1468, <https://doi.org/10.1016/j.apmr.2012.02.003>.
- F. Budini, M.M. Lowery, M. Hutchinson, D. Bradley, L. Conroy, G. De Vito, Dexterity training improves manual precision in patients affected by essential tremor, *Arch. Phys. Med. Rehabil.* 95 (4) (2014) 705–710, <https://doi.org/10.1016/j.apmr.2013.11.002>.
- About Physical Therapists (PTs) and Physical Therapist Assistants (PTAs), (2018) <https://www.moveforwardpt.com/AboutPTsPTAs/Default.aspx>, Accessed date: 11 May 2018.
- T.A. Zesiewicz, R.J. Elble, E.D. Louis, et al., Evidence-based guideline update: treatment of essential tremor: report of the Quality Standards subcommittee of the American Academy of Neurology, *Neurology* 77 (19) (2011) 1752–1755, <https://doi.org/10.1212/WNL.0b013e318236f0fd>.
- S.S. Satchidananda, *The Yoga Sutras of Patanjali*, Integral Yoga Publications, Buckingham, Virginia, 2014.
- S. Gura, Yoga for stress reduction and injury prevention at work, *Work* 19 (1) (2002) 3–7.
- N.K. Patel, A.H. Newstead, R.L. Ferrer, The effects of yoga on physical functioning and health related quality of life in older adults: a systematic review and meta-analysis, *J. Alternative Compl. Med.* 18 (10) (2012) 902–917, <https://doi.org/10.1089/acm.2011.0473>.
- H. Stolze, G. Petersen, J. Raethjen, R. Wenzelburger, G. Deuschl, The gait disorder of advanced essential tremor, *Brain* 124 (Pt 11) (2001) 2278–2286.
- E.D. Louis, A.K. Rao, Functional aspects of gait in essential tremor: a comparison with age-matched Parkinson's disease cases, dystonia cases, and controls, *Tremor. Other. Hyperkinet. Mov. (N Y)* 5 (2015), <https://doi.org/10.7916/DSB27T7J>.
- R.E. Carter, J. Lubinsky, *Rehabilitation Research: Principles and Applications*, fifth ed., Elsevier, St. Louis, Missouri, 2016.
- S. Powers, Q&A: What's the Purpose of Practicing Sun Salutations? Cruz Bay Publishing, 2007 Yoga Journal.
- R. Rosen, Here Comes the Sun: The Tradition of Surya Namaskar, Cruz Bay Publishing, 2007 Yoga Journal.
- Why sun salutations are so much more than just a warm-up, *Yoga J.* (2017), <https://www.yogajournal.com/practice/why-sun-salutations-are-more-than-a-warm-up>, Accessed date: 24 September 2018.
- B. Iyengar, *Light on Yoga*, Shoken Books, New York, NY, 1994.
- C. Sykes, The international classification of functioning, disability and health: relevance and applicability to physiotherapy, *Adv. Physiother.* 10 (2008) 110–118, <https://doi.org/10.1080/14038190802294617>.
- R. Elble, C. Comella, S. Fahn, et al., Reliability of a new scale for essential tremor, *Mov. Disord.* 27 (12) (2012) 1567–1569, <https://doi.org/10.1002/mds.25162>.
- O.T. Leyfer, J.L. Ruberg, J. Woodruff-Borden, Examination of the utility of the Beck Anxiety Inventory and its factors as a screener for anxiety disorders, *J. Anxiety Disord.* 20 (4) (2006) 444–458, <https://doi.org/10.1016/j.janxdis.2005.05.004>.
- D.J. Rose, N. Lucchese, L.D. Wiersma, Development of a multidimensional balance scale for use with functionally independent older adults, *Arch. Phys. Med. Rehabil.* 87 (11) (2006) 1478–1485, <https://doi.org/10.1016/j.apmr.2006.07.263>.
- D. Hernandez, D. Rose, Predicting which older adults will or will not fall using the Fullerton Advanced Balance scale, *Arch. PM&R (Phys. Med. Rehabil.)* 89 (12) (2008) 2309–2315, <https://doi.org/10.1016/j.apmr.2008.05.020>.
- S. Cohen, B. Mount, M. Strobel, F. Bui, The McGill Quality of Life Questionnaire: a measure of quality of life in people with advanced disease. A preliminary study of validity and acceptability, *Palliat. Med.* 9 (3) (1995) 207–219, <https://doi.org/10.1177/026921639500900306>.
- E.D. Louis, R. Ottman, How many people in the USA have essential tremor? Deriving a population estimate based on epidemiological data, *Tremor. Other. Hyperkinet. Mov. (N Y)* 4 (2014) 259, <https://doi.org/10.7916/D8TT4P4B>.
- M. Godi, F. Franchignoni, M. Caligari, A. Giordano, A.M. Turcato, A. Nardone, Comparison of reliability, validity, and responsiveness of the mini-BESTest and Berg Balance Scale in patients with balance disorders, *Phys. Ther.* 93 (2) (2013) 158–167, <https://doi.org/10.2522/ptj.20120171>.
- D. Arkadir, E.D. Louis, The balance and gait disorder of essential tremor: what does this mean for patients? *Ther. Adv. Neurol. Disord.* 6 (4) (2013) 229–236, <https://doi.org/10.1177/1756285612471415>.
- R.E. Traub, M. Gerbin, M.M. Mullaney, E.D. Louis, Development of an essential tremor embarrassment assessment, *Park. Relat. Disord.* 16 (10) (2010) 661–665, <https://doi.org/10.1016/j.parkreldis.2010.08.017>.
- E.D. Louis, D.G. Machado, Tremor-related quality of life: a comparison of essential tremor vs. Parkinson's disease patients, *Park. Relat. Disord.* 21 (7) (2015) 729–735, <https://doi.org/10.1016/j.parkreldis.2015.04.019>.
- A.I. Troster, R. Pahwa, J.A. Fields, C.M. Tanner, K.E. Lyons, Quality of life in Essential Tremor Questionnaire (QUEST): development and initial validation, *Park. Relat. Disord.* 11 (6) (2005) 367–373, <https://doi.org/10.1016/j.parkreldis.2005.05.009>.
- V. Chandran, P.K. Pal, Essential tremor: beyond the motor features, *Park. Relat. Disord.* 18 (5) (2012) 407–413, <https://doi.org/10.1016/j.parkreldis.2011.12.003>.