

President's Message

Laurel Daniels Abbruzzese, PT, EdD

At the recent Combined Sections Meeting 2020 in Denver, Colorado, I promised to fulfill my duties and obligations as the new Performing Arts Special Interest Group President. I have big shoes to fill! Annette Karim, our immediate past PASIG President is moving on to serve on the AOPT Nominating Committee. We are all so grateful for her service; and I am thrilled and honored to take on this new challenge.

CSM is always a great opportunity to reconnect with colleagues, provoke new thoughts on practice, and interact with current researchers and leaders in physical therapy. This year was particularly invigorating, because I met so many new people eager to become more engaged and advance the role of the PASIG within AOPT and the performing arts community. I want to express my particular thanks to all of the individuals that contributed to the CSM programming. We had 12 posters, 2 platform presentations, and 3 educational sessions featuring performing arts content. Our Vice President/Education Chair, Rosie Canizares will continue to recruit presenters and secure high quality educational programming for upcoming meetings. She is working on a collaboration with the Imaging SIG for a preconference course at CSM 2021 in Orlando. Stay tuned for more information!

I also want to express my gratitude for the leadership of Marissa Schaffer, the outgoing Outreach Committee Chair. The purpose of this committee is to further the PASIG's mission and vision by providing the performing arts community with easily accessible, valuable, and evidence-based resources to aid in safe and effective wellness practices. This committee has been creating high quality resources through an inclusive process that galvanized the energy and talents of our members. Some of the resources that PASIG members should soon be able to find on our website include a document for performing arts unions and governing bodies on the role of the performing arts physical therapist. I want to ensure that all of the committee's great work gets disseminated and hope that all of those committee members that did research or developed resources will stay engaged and continue to advance the PASIG into our next "act". Brook Winder has completed her term as Nominating Committee Chair, and will assume the role of Outreach Committee Chair.

Most of the PASIG leadership team is continuing on in their current role but we do have a few changes. Mark Romanick is the new Research Chair. Marisa Hentis is the new Nominating Committee Chair and Pam Mikkelsen is the newly elected Nominating Committee member. Welcome Mark and Pam! The PASIG is in great shape with our strong leadership team.

My former role as Fellowship Task Force Chair will evolve into a new role titled, a "Fellowship Advisory Board Chair". I began my PASIG volunteer experience as a member of the Fellowship Task Force. We began with revalidating the 2004 Description of Specialty Practice for performing arts, under the leadership of Mariah Nierman. The PASIG conducted a practice analysis which

informed the Description of Fellowship Practice (DFP). There are now 4 new Performing Arts Fellowship Programs:

- The Ohio State University
- Johns Hopkins Medicine
- Columbia University Irving Medical Center /West Side Dance PT
- Harkness Center for Dance Injuries at NYU Langone

The hope is that the PASIG can create a community of fellows for professional activities like journal clubs and case study presentations. The PASIG can help identify content experts and develop resources for fellowship education. We also want to support those interested in developing a Performing Arts Fellowship. The DFP is free and posted online at abptfre.org.

The **mission** of the Performing Arts Special Interest Group (PASIG) is to be the leading physical therapy resource to the performing arts community.

We are guided by our focus on **identity, quality, and collaboration**. As of February 2020, we have 676 PASIG members and 218 on the members-only Facebook group. We had \$4,898.40 in encumbered funds, and \$3,750.00 in 2020 non-rolling funds. We will continue to sponsor the International Association of Dance Medicine and Science (IADMS) from our 2020 non-rolling funds. We will continue to generate 11 citation blasts a year, contribute content to *OPTP*, and secure performing arts programming at CSM. Each year we also support a student scholarship. The 2020 Student Scholarship recipient was Hai-Jung (Steffi) Shih, PT, PhD(c), for her project, *Dancers with Flexor Hallucis Longus Tendinopathy Maintain Performance Despite Altered Lower Extremity Dynamics*. An interview between Anna Saunders, our Scholarship Chair, and Steffi is included on the next page. In addition to these initiatives, we will participate in on-going strategic planning in order to align with goals and propose innovation over the year.



PASIG Leadership: Marissa Hentis, Janice Ying, Pam Mikkelsen, Rosie Canizares, Mandy Blackmon, Annette Karim, Mark Romanick, Laurel Abbruzzese, Duane Scotti, Jessica Waters. Not pictured: Tara Jo Manal, Brooke Winder, Anna Saunders, Andrea Lasner, Dawn Muci, Marissa Schaeffer, Sarah Edery-Altas

Last but not least, I want to give a big “Shout out!” to Jessica Waters for choreographing the first annual CSM flash mob dance. We distributed the videos via Facebook and were excited to see so many join in on the fun at both the SIG “Meet and Greet” and the Orthopedic Academy’s membership party. It was a great way to celebrate our shared interest in the performing arts, raise awareness of our SIG, and make fun memories. If you have an interest in the performing arts community, and want to join our SIG, membership is free to AOPT members. It is ok if you have two left feet or cannot keep a beat. All we need is your passion and active engagement.

An Interview Between Anna Saunders, DPT, and PASIG Research Award Recipient, Hai-Jung (Steffi) Shih, PT, BS

Research Title: Dancers With Flexor Hallucis Longus Tendinopathy Maintain Performance Despite Altered Lower Extremity Dynamics

Hai-Jung Shih, PT, BS; K. Michael Rowley, PhD;

Kornelia Kulig, PT, PhD, FAPTA

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Give a brief summary of your research and why you chose this topic, including a brief explanation of the purpose of this research.

The research I presented this year at CSM is part of a 2-year study funded by PASIG. From previous studies, we know that the saut de chat (a dance specific split leap) places the highest demands on the toes, especially during takeoff. Therefore, we looked at how dancers with flexor hallucis longus (FHL) tendinopathy perform saut de chat differently, and how we could potentially use a clinical feasible measurement to inform us about biomechanical alterations in a saut de chat takeoff without having to go through extensive laboratory experiment. We chose this topic because we know that FHL tendinopathy is a huge problem in dance and there were not sufficient non-surgical studies out there that clinicians can draw upon. We needed studies that use dance-specific tasks, and answer questions such as identifying the injury mechanism and how we can treat and prevent it.

With the help of 8 dancers with FHL tendinopathy without concurrent pathology elsewhere and 11 uninjured dancers, we were able to identify several different biomechanical factors related to FHL tendinopathy. Dancers with FHL tendinopathy stayed on the ground longer before taking off, and had lower vertical ground

reaction force during ground contact (they did not push the ground as hard). Dancers with FHL tendinopathy also had lower joint torsional stiffness (their joints were more compliant in a way that they go through more range of motion under the same loading) in the metatarsophalangeal, ankle, and knee joints. Despite these changes in lower extremity dynamics, they were able to maintain jump height performance the same as the uninjured dancers.

We also found that a clinical feasible measurement, the lower limb contact posture, was able to differentiate between uninjured dancers and those with FHL tendinopathy. Dancers with FHL tendinopathy stretched their leg further in front of their bodies at initial contact. The lower limb contact posture was also associated with the biomechanical factors mentioned above (joint torsional stiffness and ground reaction force). The angle and the horizontal distance from the center for pressure (approximately toe position) to the center of mass (approximately pelvis position), taken at initial contact, can be measured using video analysis in the clinic or the field. More researchers should look into the feasibility and validity of using this measure as a movement screening for dancers at risk of FHL tendinopathy.

Did you review previous research and literature on this topic? Can you discuss how the reviewed academic literature resonates with your practice experience?

The majority of the research on FHL tendinopathy or posterior ankle pain in dancers were focused on surgical interventions. I did not see a lot of dancers when I was practicing, but when I worked with an artistic gymnastic team there were certainly FHL injuries and it was challenging not having enough literature to inform my practice.

What related or similar topics are covered in previous research?

As mentioned above, most of them were on surgical interventions and there were also some epidemiological studies on the prevalence. A previous study from our lab looked at the FHL tendon’s morphology on the ultrasound along with some clinical measures such as toe strength and endurance, but only in healthy dancers and non-dancers (Rowley et al). Rowley et al helped us build a fundamental understanding of FHL and how dancers use their toes, which led us to pursue the current study in dancers presenting with FHL tendinopathy. There were other dance-related studies, many from our lab, that look at other lower extremity injuries such as patellar tendinopathy (Fietzer et al), and characterizing common dance movements (Jarvis and Kulig), and studies about dancer’s lower extremity landing strategies (Orishimo, et al) that we were able to draw on.

Summarize the key findings of previous research; what are the important relationships between earlier studies?

Flexor hallucis longus tendinopathy is a rare condition. Even in ballet dancers, it was reported to have a 1.5% prevalence, although this is already the population with the highest prevalence. This number may be underestimated due to underreporting in dancers. A lot of the older studies were case studies or case series on surgical intervention (usually a tendon sheath release, and sometimes accompanied by an osteoplasty to reshape and repair the adjacent bone). Some studies described the functional importance of FHL in different tasks such as the push-off in gait, or providing stabilization on a demi-pointe position. However, these do not directly

The Development of Ballet Exercises With Proprioceptive Neuromuscular Facilitation Techniques for Patients With Parkinson's Disease: An Abbreviated Case Report

Christina Del Carmen, PT, DPT

Parkinson's disease (PD) is one of the most prevalent neurologic diseases in the world and it is estimated that 20 out of 100,000 persons in the United States will be diagnosed with PD per year.¹ Due to the progressive and neurodegenerative nature of PD, patients have a higher risk of falling, which can jeopardize their functional independence and quality of life. The high prevalence of fall risk with PD is associated with bradykinesia, shuffling of gait, rigidity, muscle weakness, balance deficits, and decreased proprioception. Current research has shown that because PD patients have an increased fall risk, they are at a 3 times higher risk of hip fracture than those without PD.²

The most common interventions to address motor symptoms caused by PD are drug therapy and physical therapy. Research has shown that the most effective rehabilitative programs to address postural instability include dynamic balance practice and continual adjustment to environmental demands.² Traditional exercise programs have addressed these requirements; however, there is developing evidence that has shown dance was effective in addressing balance and gait impairments while also fostering continued participation to exercise and promoting enjoyment. There has been substantial literature supporting the use of dance as an intervention to improve balance and gait in individuals with PD.³ Researchers have shown that patients with PD were 29% less active in comparison to the average elderly adult.³ Thus, as fall risk increases as PD progresses, it is imperative for this population to have a strong adherence to exercise as developing research has shown that physical activity has a neuroprotective and neuroplastic effect on the brain and has the ability to slow the degenerative process of the disease.⁴

Proprioceptive neuromuscular facilitation (PNF) is an intervention that is widely used to improve neuromuscular dysfunction with an emphasis on the trunk and uses nervous system reflexes to relax a muscle. It is used to "enhance movement re-education and expand on existing techniques already utilized for muscle strengthening and stabilization".^{1(p1535)} Researchers have shown that PNF techniques improve the swing phase of gait and dynamic balance in individuals with PD; however, the body of evidence on PNF needs further development on the efficacy of this method in the PD population.

Furthermore, there has been no research to date on the use of both ballet exercises and PNF techniques to improve dynamic balance and gait in the PD population. Thus, the purpose of this case study was to evaluate balance and gait impairments in an elderly female with PD and to determine if ballet exercises and PNF techniques were more effective at improving dynamic balance and increasing the duration of the swing phase of gait in comparison to a standard intervention of aerobic exercise, treadmill training, and balance training. Fall risk is of high concern for the PD population so the outcome measures used in the study assessed dynamic balance and single-leg stance in gait.

address the mechanism of the development of FHL tendinopathy and therefore cannot inform us how best to prevent and manage it non-surgically.

The previous study from our lab on the FHL tendon in healthy dancers and non-dancers showed that dancers were able to balance longer on a single-leg demi-pointe position, but have worse endurance for repetitive heel raises when the toes were not supported than non-dancers (Rowley et al). These findings indicate a potential over-reliance on the FHL muscle in dancers, which could be a predisposing factor for developing FHL tendinopathy. We therefore conducted a 2-year study on FHL tendinopathy funded by the PASIG to investigate the potential mechanism of FHL tendinopathy. One of the strengths of this research is that we carefully screened our dancers for obvious signs of FHL tendinopathy without concurrent pathologies like Achilles tendinopathy. We used ultrasound imaging, EMG, and motion capture to look at common dance movements such as relevés, sautes, and saut de chats.

How might practitioners experience the focal phenomenon of our research in their practice?

I am not entirely clear about what you mean by focal phenomenon, but I will try my best to answer. I think clinicians can use our findings to complement their clinical thinking and use interventions specific to the patient. Currently, there seems to be evidence of altered biomechanics and movement strategies in dancers with FHL tendinopathy. If the specific findings line up with what clinicians see in the clinic, what could we do to retrain those movements? If there are certain intervention strategies that worked in the clinic, we would want to take that and try it on a larger cohort to see if the effect still holds. This is where clinical research and intervention-base studies can come in and bridge the gap between mechanism and treatment.

What direction is needed for future research work in this area? Point the way forward for further research.

Dance-specific injury or movement research is still extremely limited. Any dance-related research would be very helpful, but in terms of FHL tendinopathy, I think the need for future work is identifying intervention strategies. Some of the ideas include specific cueing, movement retraining, foot and calf muscle strengthening, an off-loading (rest) period followed by eccentric re-loading of the tendon, etc. Other than identifying intervention strategies, there is still a lot to learn from this condition, such as the effect of different pointe shoe designs and so on. These are great opportunities to push the envelope of research about this unique condition and advance our physical therapy care for performing artists.

Best regards,

Hai-Jung (Steffi) Shih, BS, PT

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The patient was a sedentary 78-year-old female who was diagnosed with PD in 2012 and volunteered to be a part of this case study. Her primary complaints were a loss of balance and decreased aerobic endurance. In addition, the patient was likely a Modified Hoehn and Yahr Stage of 2.5 because she demonstrated “mild bilateral disease with recovery on Pull Test”.⁵ This stage indicates that PD affected the patient on both left and right sides of her body, in which she demonstrated stooped posture, forward head, decreased arm swing bilaterally, and decreased axial rotation in her trunk in gait. The Pull Test is the gold standard to assess postural instability in the PD population and the patient demonstrated a normal response to the Pull Test as she was able to recover with one step. While the patient reported no gait-related falls, she did report reduced balance since her diagnosis; therefore, balance was tested for this patient. Overall, the patient was fully independent for her age as she did not need an assistive device or physical assistance while ambulating in the clinic, so she was tested as such. Moreover, due to the student physical therapist’s expertise in ballet, the patient’s interest in dance, previous long-term history of adherence to a Zumba exercise program, and her ability to ambulate independently, ballet was an appropriate intervention for this patient.

Based on the objective measures obtained from the examination, the patient’s impairments included decreased range of motion, decreased muscle strength, and balance, and gait impairments. Despite these impairments, the patient was functionally independent at her baseline measurement; and thus, it was appropriate to use dance and PNF as interventions to improve gait and balance measures. The plan of care was as follows: the first 3 weeks the patient learned ballet exercises within the format of a standard ballet class and the last 3 weeks of treatment PNF techniques were added into the treatment in combination with the ballet class.

During the first half of the study, the patient attended a 45- to 60-minute ballet class 2 times per week for 3 weeks. Following a 4-week washout period due to sickness, the sessions were 45- to 60-minutes 2 times per week for 3 weeks except for the last week. Due to a conflict with availability, the patient was only able to attend one session during the last week of testing. Each session began with a 5-minute warm up that consisted of walking at a brisk pace or dynamic stretches, such as lunges, high kicks, high knees, and buttock kicks. Like a typical ballet class, after warming up, the patient proceeded to do ballet exercises at the ballet barre for approximately half of the class. During a standard ballet class, exercises begin at the ballet barre to serve as a warm-up for exercises or combinations in “center”. Exercises in center are done without the barre and occur in the center of the room or moving across the studio space. These exercises require more control and are usually a combination of steps done at the barre.

During the second half of the study, after the warm-up, a D1 PNF pattern to the lower extremities was used to improve single-limb balance during the swing phase in gait. A D1 pattern begins with a lower extremity with the hip extended or straight, internally rotated, and abducted, the knee extended, and ankle plantar flexed (Figure 1). For the remaining sessions, the patient completed 3 sets of 15 repetitions per lower extremity of the D1 pattern in standing while facing the barre with both upper extremities placed on the barre to apply the exercise to a more functional position. By the second week, a yellow, low-resistance band was incorporated into the second and third sets to apply a resistance against the desired movements so the patient would have to increase her efforts to do the movement correctly (Figure 2). The addition of an ipsilat-



Figure 1. PNF D1 pattern start and end positions. PNF indicates proprioceptive neuromuscular facilitation.

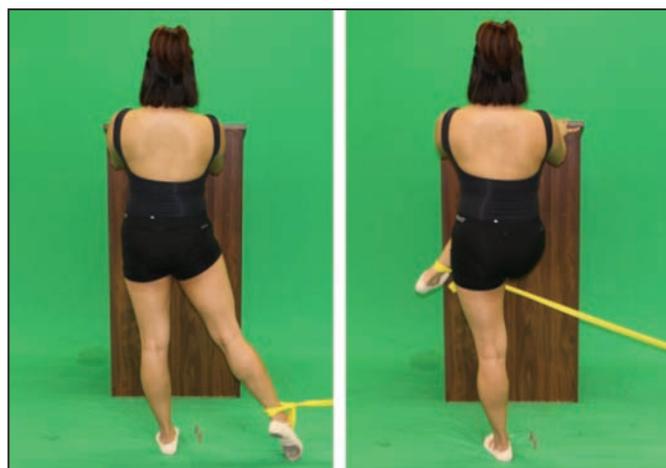


Figure 2. PNF position with resistance band positioning in starting and end positions. PNF indicates proprioceptive neuromuscular facilitation.

eral arm movement in a “high fifth” ballet position was added to increase complexity of the exercise and improve muscle activation and coordination during gait (Figure 3).

The patient was able to retain the ballet vocabulary and demonstrate steps from previous sessions throughout the study. As the sessions progressed, she improved in balance, muscle coordination, motor control, and confidence as the movements became more familiar to her. The patient improved in dynamic balance in accordance to her scores on the Functional Gait Assessment (FGA) and Functional Reach Test (FRT). In regards to the FRT, the patient demonstrated minimal detectable change in the right arm, but not in the left arm (Table 1). For the FGA, the minimal clinically important difference for the FGA in the PD population is 4 points and the patient showed a clinically significant change of 4 points at the final assessment of the FGA. For the Sharpened Romberg Test, however, scores decreased at the mid-assessment and the follow-up. The Sharpened Romberg Test is conducted with the hips in neutral. Thus, the results were most likely variable since the patient was trained in hip external rotation for ballet. Additionally, a video analysis of the patient’s gait was recorded during mid-assessment and the final assessment; however, a limitation to the study was that gait was not recorded during the initial assessment. Moreover, the patient’s time in single-limb stance increased from 36 msec at

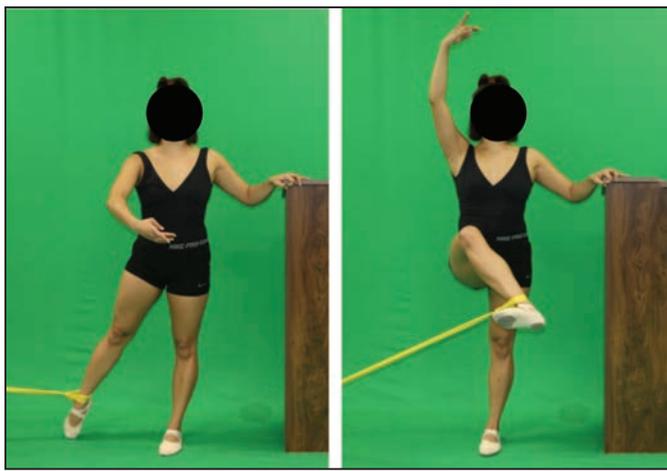


Figure 3. PNF position with the coordination of the ipsilateral upper extremity. PNF indicates proprioceptive neuromuscular facilitation.

the reassessment to 40 msec in the follow-up assessment (Figure 4 and 5). Additionally, in comparing the patient's posture at initial contact from the mid-assessment to the follow-up assessment, she increased from 21° of hip flexion to 22° and decreased in trunk flexion from 8° to 6°.

Limitations in the case report include that this case report was not generalizable to all patients with PD as it was only one patient. The patient had significant improvements; however, she would have benefitted from involvement in most exercise rehabilitation programs since she was a non-exerciser. In addition, the

patient was limited in her ability to execute more complex, single-leg stance movements due to her decreased ability to maintain static and dynamic balance on one lower extremity without upper extremity support. Thus, using ballet exercises as an intervention to address gait and balance may be limited to patients with PD that are mildly to moderately impaired by the disease process given the nature and difficulty of ballet.

This case study suggests that using ballet and PNF techniques may be useful for patients who are interested in ballet and need variation and desire to be cognitively challenged. According to Fox et al,⁶ there are 5 key principles of exercise that stimulate neuroplasticity in PD, which in summary are physical activities that are intensive, complex, and rewarding and are executed often, and introduced early on in the disease. Due to the multi-faceted and dynamic nature of ballet, in which it challenges an individual physically and cognitively, and the fact that PNF has the ability to re-educate and improve motor dysfunction, the use of ballet exercises and PNF may stimulate increased neuroplasticity in comparison to traditional physical therapy interventions. However, more research should be conducted to support this theory. Additionally, physical therapists who are unfamiliar with ballet can be taught simple ballet exercises that can be performed as rhythmic movements to music in the clinic. This may assist individuals with freezing or difficulty with initiating movements to begin moving with greater ease due to the change of environment and external cues.

Future research should establish standardized protocols, dosage, and periodization for ballet as an intervention to address gait and balance in PD patients. Other factors to consider are standardizing complexity of the exercises and verbal and external cueing. In addition, more research is needed on using PNF in combination with

Table 1. Outcome Measures for Pre- and Post-treatment

Outcome Measure	Initial Assessment	Post-treatment	Comparative/Normative Value
Functional Gait Assessment	20/30	24/30	≤ 22 effectively predicts falls & ≤ 20 predictive of unexplained falls in the next 6 months for older adults.
Functional Reach Test	R: 11 in, L: 11 in	R: 14 in, L: 13 in	Cut off scores for PD patients are <12.50 in (31.75 cm), which indicate fall risk.
Romberg Test	Negative; 30 sec eyes open, 30 sec eyes closed	Negative; 30 sec eyes open, 30 sec eyes closed	No normative data, but 184 volunteers performed the Romberg test & they maintained their balance for 30 sec, eyes open & closed.
Sharpened Romberg Test	Positive; Eyes open for R anterior: 17 sec & 20 sec L anterior: 18 sec w/ modified tandem stance & loss of balance, 29 sec & 65 sec. Eyes closed: Did not attempt for safety	Positive; Eyes open for R anterior: 17 sec & 20 sec L anterior: 18 sec w/ modified tandem stance & loss of balance, 29 sec & Eyes closed: R anterior 8.15 sec & 22.26 sec with modified tandem stance 10.35 sec & 13.95 sec	For ages 70-79, the cut off scores for right anterior tandem stance with eyes open is 30 sec. & for eyes closed 16 sec.
Single Leg Stance	L: 3.95 sec & 2.94 sec R: 2.16 sec & 3.50 sec	Not reassessed due to lack of reliability to function	The cut off score was <10 sec for PD patients with a history of one or more falls.
Berg Balance	52/56	Not reassessed due to ceiling effect	Scores between 41 and 56 indicate low fall risk.

Abbreviations: PD, Parkinson's disease, sec, seconds; cm, centimeters

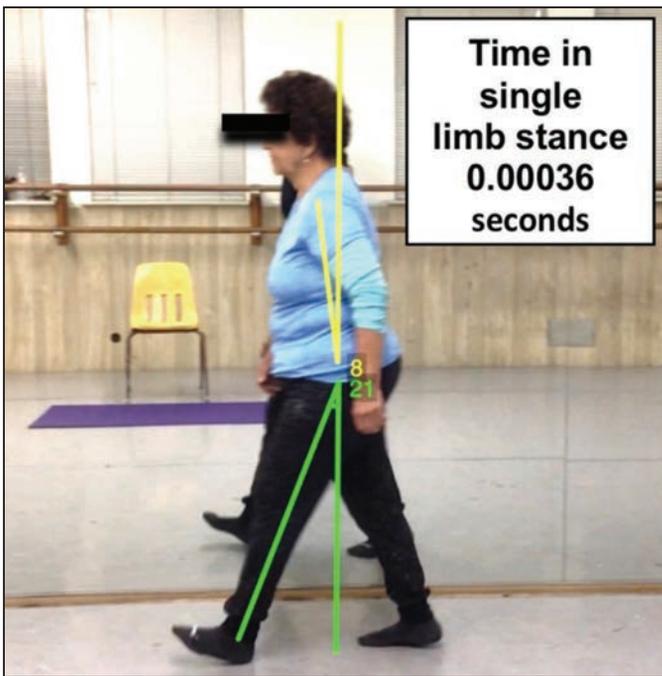


Figure 4. Mid-assessment screen shot of gait using the Hudl Technique™ application. Time in the swing phase of gait was 36 msec.

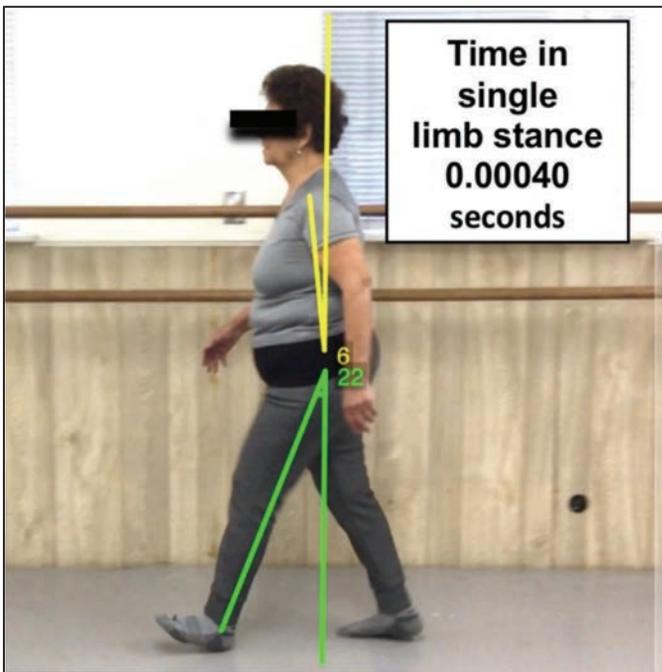


Figure 5. Follow-up screen shot of gait using the Hudl Technique™ application. Time in swing phase of gait was 40 msec.

ballet. Studies examining the effects of training the arabesque position in ballet and terminal stance may also be of value in increasing the stride length of PD patients.

In summary, since the literature supported the use of dance as an intervention for PD patients and the case study supported the use of both ballet and PNF, the use of both treatments may be useful for individuals with PD to address balance and gait impairments.

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