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Effects of Walking Poles on Posture and Gait

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This Scholarly Project, submitted by Kate Darnell, Tatum Hall, Sadie Hefta, Jessica Lynch, Jenna Sagedahl, and Nicole Salfer in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

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(Chairperson, Physical Therapy)

PERMISSION

Title Effects of Walking Poles on Gait and Posture

Department Physical Therapy

Degree Doctor of Physical Therapy

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Signatures

Date 10/20/17

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ABSTRACT

INTRODUCTION: Walking poles have become increasingly popular not only as a tool for exercising, but also as an assistive device. Physical Therapists use them to assist patients with balance during ambulation. **PURPOSE:** The purpose of this study is to look at the effects of walking poles on gait speed and posture. **METHODS:** This study included 60 community ambulators between 21-74 years old (19 males and 41 females), seen for a single session. Participants were fitted for walking poles and given a 3-minute warm-up period to become comfortable with them. A 10 Meter Walk Test (10 MWT) was performed with and without walking poles. Additionally, pictures were taken standing in front of a posture grid and while walking on instrumented walkway (GAITRite) with and without walking poles. Participants completed a walking pole survey at the end of the session. **RESULTS:** It was found that walking poles do not significantly change gait speed or posture during a single session. Forty-three percent (43%) of the participants perceived improvement in posture with use of walking poles, though only 11.7% of participants posture was found to improve by researchers. Gait speed decreased slightly overall with the use of walking poles during the 10 MWT and GAITRite, but was not statistically significant. **CONCLUSION:** Walking poles do not significantly change gait speed or posture in community ambulators with in this single session study, though many participants perceived improved posture. Only a few participants had ever used walking poles prior to the study and only a short practice session was allotted. Future studies could explore the effects of walking poles on posture

and gait after a longer period of practice with the poles (i.e, 6 weeks). Also, future studies could compare effects of walking pole and other assistive devices (i.e., cane).

CHAPTER I

INTRODUCTION

Walking poles have increased in popularity due to the potential health benefits during exercise and fitness activities in people of all ages. Distributors of walking poles advertise an improvement of posture, increased walking speeds, more efficient gait mechanics, aerobic benefits, and improved balance.[1] Nordic walking is defined as walking with poles in a reciprocal gait pattern for the purpose of exercise. Compared to brisk walking without poles, Nordic walking showed greater benefits for both short-term and long-term effects on the cardiorespiratory system.[2,3] Walking pole use was also beneficial in the prevention of a wide range of diseases.[4,5] These boasted benefits have reached an audience that utilizes them for a variety of reasons. The different types of walking poles, ranging in durability and weight, allow the user to choose a walking pole that is best fit for their preference, whether that be exercising, adventuring, or simply for added support.

In a systematic review looking at randomized controlled trials and observational studies analyzing walking poles, benefits to parameters such as resting heart rate, blood pressure, exercise capacity, maximal oxygen consumption, and quality of life were noted.[2] Improved aerobic fitness levels have been shown to be a benefit of walking poles by increasing the amount of musculature being used during walking or hiking.[6] Engaging more muscles in turn increases metabolic rate. This type of walking can provide a full body workout.[7]

In a study performed to investigate the impact of Nordic walking on 12 healthy adults, age 60-80, it was found that eight-week training intervention has the potential to improve both gait patterns and postural alignment.[8] The study included two 6-minute walk tests (one with poles, one without poles) and six 5m walk trips (three with poles, three without poles). Gait and postural variables were compared between conditions with and without poles as well as before and after intervention. The results following training displayed increased stride length, increased gait speed, increased lower extremity power generation, and a more upright postural alignment. The study reveals that the use of walking poles may improve an overall shift towards a more normal gait pattern and posture, but an eight-week training session may be necessary for novice Nordic walkers to perfect technique and for their optimal benefits.

In addition to health benefits, the use of walking poles as compared to the use of alternative assistive devices such as walkers or canes, has a positive psycho-social effect on the user.[8] Instead of seeing themselves as disabled or reliant on a device, they see themselves as athletes who are able to explore and adventure as they had before. The mental attitude of the individual using walking poles is an important factor. Compliance with using an assistive device will increase so long as the individual maintains a positive attitude around it. The walking poles also have the ability to distribute weight between the upper and lower extremities which relieves compression on joints throughout the body.[9,10,11] This can be beneficial for individuals who have pain due to arthritis or similar pathologies.

Walking speed is a strong indicator for assessing and monitoring functional status and overall health in a wide range of populations.[12] Diminished gait speed can be used as a marker of poor health status, impaired neurological, and muscular factors.[13,14] Variability in gait dynamics have been studied as predictors for fall risk. Using walking poles improves gait parameters by increasing a person's base of support and giving four points of support to bear weight through instead of two. This can improve stability while ambulating on uneven terrain or on a smooth walking path.[15,16] The four points of contact increases the amount of feedback the user receives which allows for adaption to equilibrium disturbances.[17]

Evidence suggests that Nordic walking leads to a longer stride and increased speed, along with decreasing ground reaction forces with respect to conventional walking.[18] Use of walking poles increases balance and creates a more upright posture with hand placement in front of the body. With further research on how walking poles affect gait dynamics and posture, they could become an alternative assistive device to patients needing a moderate amount of stability.[19]

The purpose of this study is to determine the effectiveness of walking pole use on posture and gait speed of community ambulators. It is hypothesized that the use of bilateral walking poles will improve posture and gait parameters. Limited research has been done in regard to walking poles and their effects on both posture and gait speed. Posture with and without walking poles will be studied during ambulation and standing.

CHAPTER II

METHODOLOGY

Participants

This research received University of North Dakota approval through the Institutional Review Board (IRB) IRB-201704-316 approval. Appendix AEach participant signed a consent form prior to the study and filled out a survey upon completion of the survey (Appendix B and C).

Sixty participants, 19 males and 41 females, were recruited to analyze posture, gait speed and subjective opinions regarding walking pole use. The participants were recruited by word of mouth and were healthy community ambulators within from the surrounding local community. Exclusion criteria included individuals who currently used an assistive device, were not community ambulators, or had history of a recent injury or impairment within the past three months that would affect gait and/or use of walking poles. Impairments including, but not limited to, cardiovascular, musculoskeletal, and upper/lower extremity issues were taken into consideration. Ages of the subjects ranged from 21 years old to 74 years old, with the average age being 39 years. Two age ranges were used, the younger group, ages 21-34 years old, had an average age of 23.4 years. The older group, ages 35-74 years, had an average age of 57.5 years. The average height of the participants from the younger group was 5'9" while the average height of the older group was 5'5". Overall, the average height of all subjects was 5'7". Only four participants (6.6%) had used poles prior to the study.

Instrumentation

Walking Poles

Exerstrider Products Inc.® (Madison, WI) walking poles were used during this study (Figure 1). There are three different types of Exerstrider® poles include Nordic walking and fitness, stability and medical, and travel and adventure.[20] In this study, the stability and medical poles were used. Components of the walking pole include two hand grips that are labeled right (R) and left (L). The tips of the poles were the hiking tips to provide traction for a wide variety of surfaces, as determined by preference versus other tips during the pilot study. Figure 1. The standard walking poles can be adjusted for heights of 4' 2" to 6' 0". A taller version of the walking poles, Exerstrider XL®, were used for participants of heights 6' 0" to 6' 8". The walking poles had a button, lock-in method to secure the height they were set at, increasing stability and safety as compared to poles with a twist lock-in method. Figure 2.

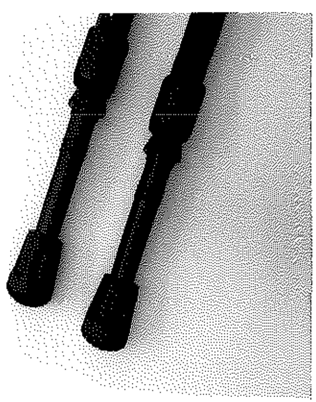

Figure 1. Walking Pole Tips

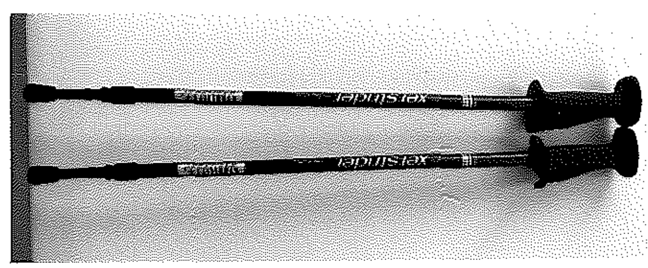

Figure 2. Walking Poles

GAITRite

The GAITRite® is a 3x14 foot electronic mat with embedded pressure sensors that measure gait and other parameters including speed, stride length, and step length.[21]

When moving on the padded walkway, GAITRite software changes the information into foot placement patterns and overall gait patterns that can later be reviewed. Video recording is also available to analyze other aspects of gait mechanics, such as posture, while participants are walking. The GAITRite specifically has been shown to have good test-retest reliability (ICC=0.95) of spatial and temporal gait measurements, and is said to be the gold-standard in this analysis.[22] Figure 3.

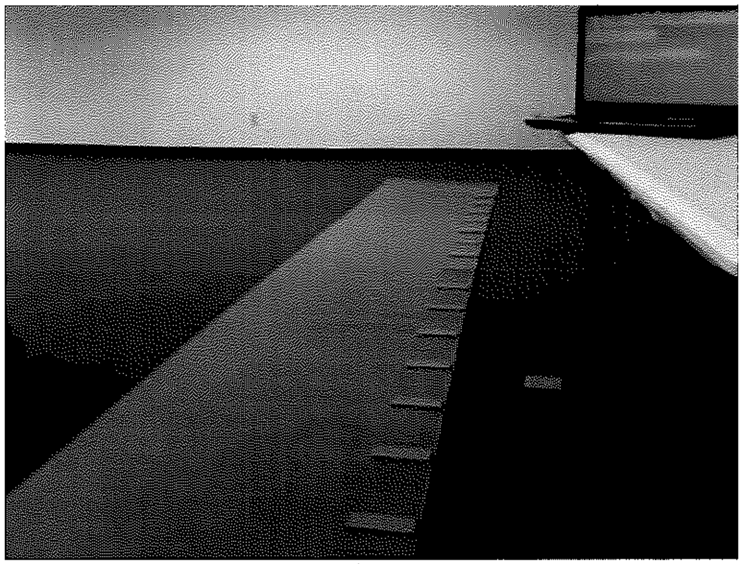

Figure 3. GAITRite Electronic Mat

<u>10-Meter Walk Test (10 MWT)</u>

The 10 MWT is a performance measure used to assess walking speed in meters per second.[23, 24] Participants walking speed is timed for six meters, allowing two meters for acceleration and two for deceleration. It can be used to determine functional mobility, gait, and vestibular function. The reliability of the 10 MWT test has been tested in the forms of test-retest, inter-rater, and intra-rater. The 10 MWT has an inter-rater and intra-rater reliabilities were between 0.95 and 0.99 for both of the methods. The 10 MWT required minimal equipment and minimal set up time. The materials required include:

meter sticks to measure proper distances, tape to mark specific distance for participant to walk, and a stopwatch to time the assessment.[25] Figure 4.

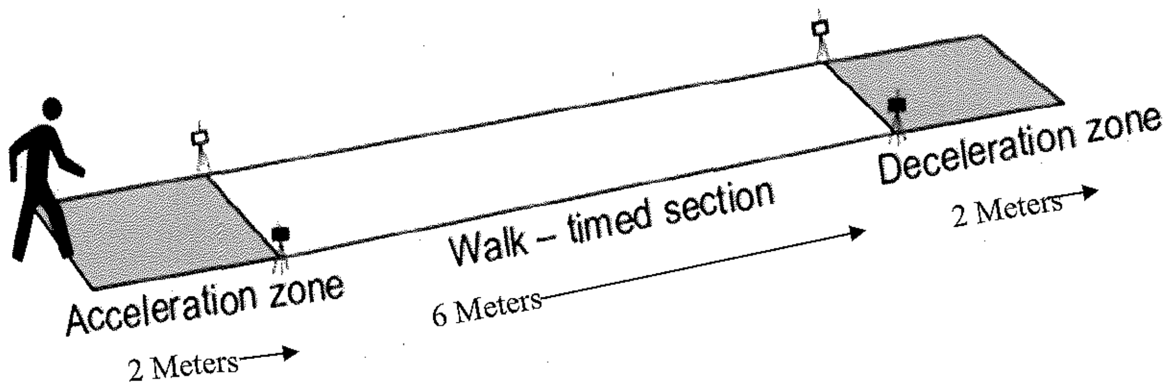

Figure 4. 10 MWT Diagram

<u>Photo/Video Recorder</u>

To conduct the data collection, two iPads, Version 9.3.5 were used with the Hudl® Technique technology. The iPads were used in order to download the Hudl application and were available through University of North Dakota Physical Therapy Department. Hudl Technique is an application used to analyze movement of the body. It offers tools to study performance, side-by-side analysis, posture, diagrams, and edit and share video. Reference lines, grids, and notes can be applied to pictures or videos for accurate movement and initial feedback to subject. Video recordings can be sped up, slowed, down, paused, and compared for the subject both in real time and slow motion. Hudl Technique allows for data to be collected in a time efficient manner and is easily accessible. Analyzing posture and gait mechanics can be a challenging task without the proper technology.[26]

Survey

Upon completion of the testing, a survey was given to each participant. This consisted of 9 questions that included past injuries, current ease of walking, ease of walking pole use, the participants' opinion on their posture with and without the walking poles, benefits of walking poles and the participant's opinion on whether or not walking poles improved balance. The survey also had a section for additional comments for participants to provide. A copy of the survey can be found in Appendix C.

Procedure

Data collection occurred over two separate days. The participants began the study by signing the informed consent and being fitted for walking poles. Appendix A. They were given time to warm up and get comfortable using the walking poles before being tested in the closed environment. Once in the testing room, the subject stood in front of a posture grid for posture analysis. The subject proceeded to perform a 10 MWT, followed by the GAITRite walking trials. All data collection was performed with and without poles. To complete the procedure, participants were asked to fill out a short survey regarding their perception of walking poles. Overall, the process took about 15 minutes for each participant.

Fitting Poles

Following consent, subjects were fitted for walking poles. This was completed by having the subjects place the tip of the walking poles in line with their heels and elbows at side with hands around the hand grips of the walking poles. The walking poles were adjusted until the participant's elbows were at a 90-degree angle.[27] After fitting was completed, the subjects were asked to walk for a three-minute period at a comfortable walking speed using a reciprocal gait pattern. The purpose of this was to allow the participants to become comfortable with the walking poles prior to further testing. A total of two subjects required extra time to become comfortable and two extra minutes were added to their warm-up time.

While fitting participants for correct walking pole height and allowing them to get comfortable with the Nordic walking style, two participants displayed difficulties with the length of the pole. The tips of the walking poles often contacted the ground during the swing phase of the gait cycle, disrupting the normal walking pattern. Walking poles for these two participants were fit for balance improvement instead of the Nordic walking height that was used for other participants. The fit for balance includes the elbows at 90 degrees of flexion and the pole positioned perpendicular to the ground. The tips of the poles were directly under the grips so that they were out in front of the feet. Figure 5.

Standing Posture

For collection of photos, participants were asked to stand 1.5 feet (18 inches) away from a posture grid which hung on the wall. The participants stood with their feet lined up behind a taped reference point for consistency in distance of each participant during photos. Subjects were asked to "stand comfortably and look straight ahead" for photos allowing for the foot of the poles to be aimed toward their heels and arms held at a 90° angle. Photos of front, side, and back views of each subject were collected with and without the walking poles for comparative data. All photos were collected through the Hudl Technique application. An iPad was positioned nine feet from the grid for all photos, regardless of participant height.

When analyzing the photos, references of the head, neck, shoulder, and trunk were used in order to view changes in posture. Evaluation of the subject's right side

Figure 5. Fitting Poles

posture, with and without walking poles, was analyzed side by side through the Hudl application. Two independent reviewers collected the data recording whether the subjects head and trunk posture was better, worse, or unchanged with the use of walking poles in comparison to no walking poles. Data results were then compared between the reviewers, any discrepancies within the independent reviewers' data was further analyzed by a third reviewer. Figure 6.

Walking Posture

Hudl Technique application on an iPad was used to collect data of walking posture from the participants. For collection of video, participants were recorded while walking over the GAITRite. The recording began as soon as the participant took their first step onto the GAITRite mat. The recording ended when the participant took their first step off of the GAITRite mat. Video recording of participants was completed during each of the six

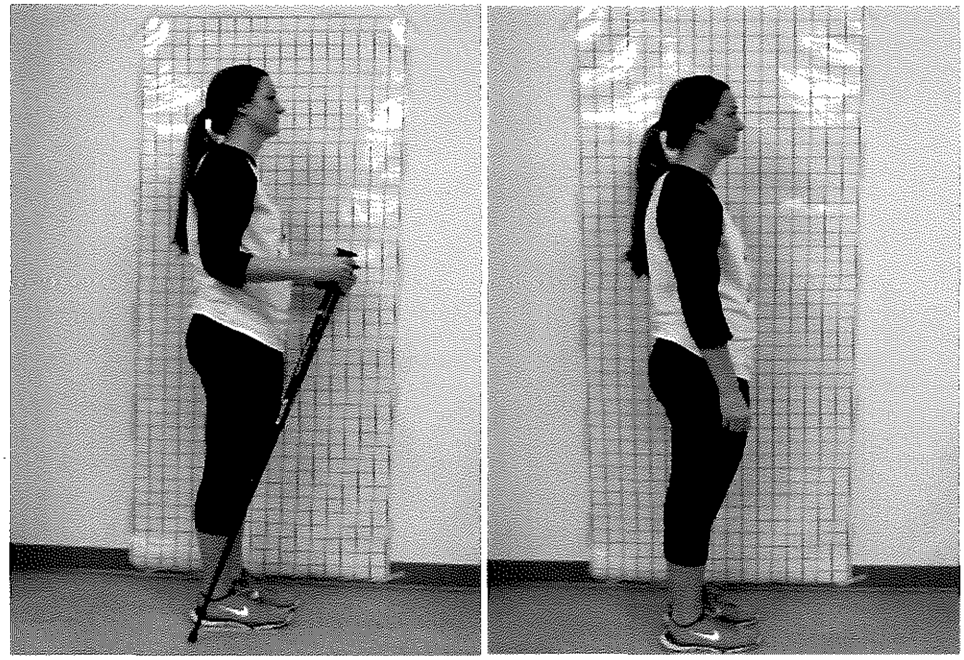

Figure 6. Standing Posture

trials, three without poles, three with poles, for comparative data. Placement of the iPad was 12 feet away from the GAITRite mat and directly in the center of the mat. The iPad was positioned in the same location for all video recordings regardless of participant height.

Walking posture was evaluated during single limb stance of the limb closest to the iPad. For comparison, the third trial of walking on the GAITRite with and without poles were placed side by side through the Hudl Technique application. The video was paused for further comparison during single limb stance of the first cycle of gait, when the tibia was perpendicular to the ground.[28] The position of the head and trunk were used as points of reference used for comparison. Figure 7. Data analysis for walking posture was conducted identically to analysis of standing posture.

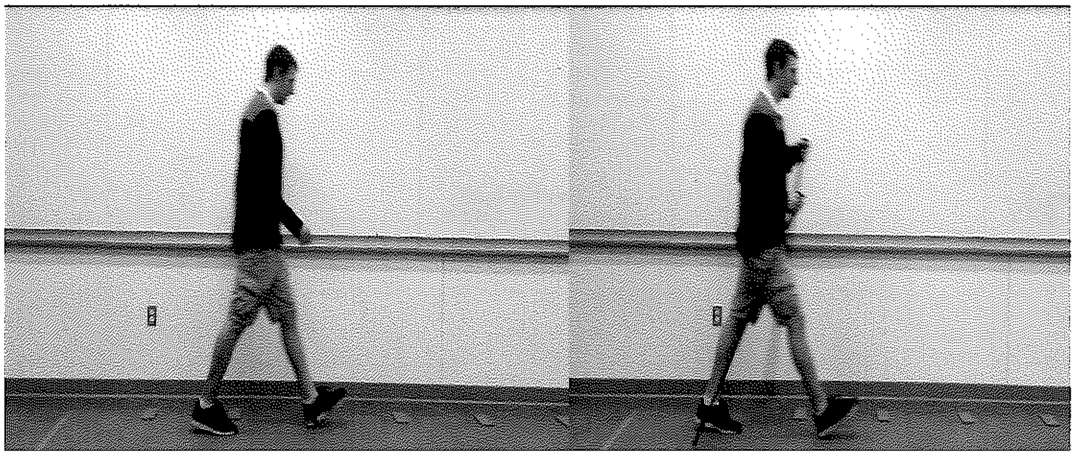

Figure 7. Walking Posture

10-Meter Walk Test

Participants were given clear and concise instructions before completing the 10 MWT. Participants were asked to verbalize understanding before beginning. If the subjects did not have proper walking pole form, stepping with left foot and moving right pole, 10 MWT would be stopped and re-tested. All participants successfully completed the 10 MWT six times, three with poles and three without poles. The average of those three times was recorded and used at their normal walking speed with and without poles. Consistent, verbal instructions were given to each participant: "You will begin as close to, but behind the piece of tape on the floor. Walk at a normal and comfortable walking speed all the way through the last piece of tape on the floor, and then come to a stop. We will repeat this process three times with the poles and three times without the poles. Start when you are ready." Stopwatch was started when participant's foot broke the plane of the tape measured two meters before/after the starting line. Stopwatch was stopped when participant's foot broke the plane of the tape measured eight meters after the starting line. Only middle six meters of the 10 MWT is actually timed. During both testing sessions, the 10 MWT was performed by the same researcher each time to display high rating of inter-rater reliability.

GAITRite

Participants were asked to walk across the GAITRite six times, three times with poles and three times without poles. All subjects were instructed to walk at a comfortable walking pace. When the instructor said "go" the participant could begin walking. There were two meters at the beginning and end of the GAITRite to allow subjects to achieve normal walking speed. Data was collected for each of the six trials. The walking speed was averaged between the three trials with walking poles and the three trials without walking poles.

Survey

To complete the procedure, participants were asked to fill out a short survey regarding their demographics, recent medical history, previous use and perception of walking poles. See Appendix C.

CHAPTER III

RESULTS

All 60 subjects completed test procedures. Out of the 60 subjects, two needed increased warm up time (a few minutes) to become comfortable using walking poles with reciprocal gait pattern. The data analysis looked at gait speed changes using the 10 MWT and GAITRite results, standing and walking posture changes, and perceived changes using a survey. Results of the 10 MWT and GAITRite were comparable. This is advantageous for future studies to know that the GAITRite mat is not necessary to achieve reliable results for determining gait speed.

During the 10 MWT participants had a minimum speed of 1.00m/s and 1.17m/s, difference of 0.17m/s, with and without poles respectively and maximum speed of 1.97m/s and 2.22 m/s with a difference of 0.25m/s. Table 1. As for the GAITRite participants had a minimum speed of .96m/s and 1.11m/s, difference of 0.15m/s, with and without poles respectively and maximum speeds of 1.82m/s and 1.86m/s with difference of 0.04m/s. Table 2. The t-test values of 10 MWT: $t(59) = -8.072$, $p < .001$ and GAITRite walking speed of $t(55) = -7.617$, $p < .001$, concluded that walking with walking poles decreased speed of participants. The mean speed of both with and without walking poles, 1.53 and 1.51 respectively and 1.34m/s and 1.43 m/s shows for both the 10 MWT and GAITRite that the participants walked faster without poles. Table 1 and 2.

Intra reliability was tested of PT skills with the 10 MWT and the "gold standard" of the GAITRite. Results showed that with poles intra reliability scored .933 with poles and .831 without poles. These results showed that that there is a good reliability between the two. Future research and therapist can take these results and feel confident using the 10MWT in the clinic, when a GAITRite is not easily on hand. Fifty of the 60 participants walked slower when using the walking pole compared to walking without the poles.

Table 1. Participant Speed on 10 MWT (m/s)

	M	SD	Minimum/Maximum
With Walking Poles	1.3920	.21971	1.00/1.97
Without Walking Poles	1.5147	.20174	1.17/2.22

Table 2. Participant Speed on GAITRite (m/s)

	M	SD	Minimum/Maximum
With Walking Poles	1.3459	.17699	.96/1.82
Without Walking Poles	1.4316	.14385	1.11/1.86

When comparing the age groups, using both the 10 MWT and the GAITRite, the <35 age group had a faster gait speed than the $\geq$ 35 age group for both walking with poles and without poles. Table 3. Normative speed for healthy adults in their twenties and thirties include 1.39-1.46m/s for males and 1.41-1.42m/s for females. Compared to our data, the average participant speed without poles was in the range on the GAITRite and above the range on the 10 MWT. The participants walked below average walking speed when using walking poles. Normal walking speeds for community-dwelling older adults who are healthy generally range from 0.90 to 1.30m/s, which is in the range of the mean gait speeds for participants ≥ 35 with both the 10 MWT and GAITRite.[29]

Table 3. Comparing Age Differences in Gait Speed with and without Poles using 10 MWT and GAITRite

Test	Age	N	Mean	Standard Deviation
10 MWT with Poles	<35	29	1.4555	0.19555
	≥35	30	1.3383	0.22894
10 MWT without Poles	<35	29	1.5617	0.17366
	≥35	30	1.4743	0.22128
GAITRite with Poles	<35	27	1.4085	0.16136
	≥35	30	1.3160	0.03580
GAITRite without Poles	<35	28	1.4768	0.12329
	≥35	29	1.3907	0.14762

When comparing males to females, using both the 10 MWT and the GAITRite, males had a slightly faster gait speed when using walking poles. Table 4. The 10 MWT showed that males also had a faster gait speed when not using walking poles. The GAITRite showed that the mean female gait speed is slightly faster without the use walking poles when compared to the mean male gait speed. Males will typically walk faster than females due to increased height and step length. When comparing the gait difference between males with and without the poles using the GAITRite the difference is 0.027m/s. When comparing the gait speed difference between females with and without poles using the GAITRite the difference is 0.0957m/s.

Table 4. Comparing Gender Differences with Gait Speeds with and without Poles using 10 MWT and GAITRite

Test	Gender	N	Mean	Standard Deviation
10 MWT with Poles	Male	19	1.4547	0.27399
	Female	41	1.3629	0.18623
10 MWT without Poles	Male	19	1.5579	0.26555
	Female	41	1.4964	0.16432
GAITRite with Poles	Male	18	1.4006	0.19877
	Female	40	1.3363	0.17787
GAITRite without Poles	Male	17	1.4276	0.13074
	Female	41	1.4320	0.14747

When standing posture was evaluated, there were 12 discrepancies noted between the two assessors. The deciding factor was a third, independent assessor. In the walking posture trials, 9 discrepancies were mediated by the third independent assessor. When analyzing head posture, there was an 11.7% improvement. Table 5. Worsened posture was noted in 13% of the participants, while 75% of participants had posture that was unchanged. Trunk posture in standing demonstrated 16.7% improvement, 16.7% of participants had worse posture, and 66.7% of participants had posture that was unchanged. Table 6. Overall, statistical analysis of standing posture with and without walking poles revealed no significant differences. Table 7.

Table 5. Standing Head Posture

	Frequency	Percent	Valid Percent	Cumulative Percent
No Change with Poles	45	75	75	75
Better with Poles	7	11.7	11.7	86.7
Worse with Poles	8	13.3	13.3	100
Total	60	100	100	

Table 6. Static Trunk Posture

	Frequency	Percent	Valid Percent	Cumulative Percent
No Change with Poles	40	66.7	66.7	66.7
Better with Poles	10	16.7	16.7	83.3
Worse with Poles	10	16.7	16.7	100.0
Total	60	100	100	

Table 7. Overall Standing Posture

	Frequency	Percent	Valid Percent	Cumulative Percent
No Change with Poles	40	66.7	66.7	66.7
Better with Poles	10	16.7	16.7	83.3
Worse with Poles	10	16.7	16.7	100.0
Total	60	100	100	

Walking posture revealed no significant statistical differences with and without use of walking poles. There was a 20% improvement in head posture during walking with poles whereas 23.3% of participants had worsened posture, and 56.7% of participants had posture that was unchanged. Table 8. Trunk posture while walking with poles demonstrated an 18.3% improvement, 18.3% of participants had worse posture, and 63.3% of participants were unchanged. Table 9 and 10. Chi squared was calculated but did not meet assumptions for both standing and walking posture.

Table 8. Walking Head Posture

	Frequency	Percent	Valid Percent	Cumulative Percent
No Change with Poles	34	56.7	56.7	56.7
Better with Poles	12	20.0	20.0	76.7
Worse with Poles	14	23.3	23.3	100.0
Total	60	100	100	

Table 9. Walking Trunk Posture

	Frequency	Percent	Valid Percent	Cumulative Percent
No Change with Poles	38	63.3	63.3	63.3
Better with Poles	11	18.3	18.3	81.7
Worse with Poles	11	18.3	18.3	100.0
Total	60	100	100	

Table 10. Overall Walking Posture

	Frequency	Percent	Valid Percent	Cumulative Percent
No Change with Poles	32	53.3	53.3	53.3
Better with Poles	13	21.7	21.7	75.0
Worse with Poles	15	25.0	25.0	100.0
Total	60	100	100	

In the completion survey, participants were asked to rank how easy it was to walk with walking poles on a scale from 0-10, with 0 being easy and 10 being difficult. The overall average score was 3.16, showing ease of picking up the new skill. This statistic did, however, vary between the younger and older age groups, 21-34 years and 35-74 years. The older group of participants had an average score of 3.61, a slightly higher score than the younger group, having a score of 2.79. This indicates that the older population had a more difficult time getting comfortable with using the walking poles compared to the younger population. Perceived posture also differed slightly between the two groups. The younger population had a perceived posture score of 6.66 on a 0-10 scale with 0 being poor and 10 being ideal posture without the use of walking poles, while the older population had a score of 7.42, averaging 7.05. This was slightly lower than the average score for perceived posture with the use of walking poles, 7.61. The increased score of perceived posture indicates that the participants had a better perception of their posture while using walking poles as compared to their normal standing and walking posture. Table 11. The survey also prompted for opinions of where the participants would use walking poles if they were to use them. Almost half, 28 (46.6%), of the participants responded that they would use them while hiking. An additional 22 (36.6%) participants indicated that they would use walking poles to exercise or on uneven terrain. Table 12. This population did not indicate that they would utilize the walking poles to improve their balance or stability at this time. This is to be expected given the fact that all subjects are normal community ambulators.

Table 11. Posture Perception

	<35 years	>35 years	Average
Perceived Posture with Poles	7.77	7.45	7.61
Perceived Posture without Poles	6.66	7.42	7.05

Table 12. Benefits of Walking Pole Use

	<35 years	>35 years
Yes	22	20
No	5	10

Data between the participant survey and posture analysis results was compared. This was done in order to analyze the participant's perception of how walking poles affected their posture against posture analysis results. Results showed 43.4% participants perceived an improved posture when using walking poles, 18.3% felt their posture was worsened, and 35.0% felt their posture was unchanged. The postural analysis results showed that 16.7% participants had an improved posture, with 16.7% worse, and 66.7% unchanged. Results of postural analysis and survey results of perception of improved posture correlated for 39% of the participants. These results show that even if participants posture was unchanged, many participants had the perception that walking poles positively affected their posture.

CHAPTER IV

DISCUSSION

This study evaluated the effects of walking poles on gait speed and posture. The results did not show a significant improvement of posture or gait speed. Gait speed actually decreased slightly while using walking poles in both the younger and older population. Participants tended to look down more while walking with the poles, which may be a factor in decreased walking speed, as well as poorer posture. This could be due to the fact that only 4 participants had used walking poles prior to this study, with the rest being novice walking pole users. An increased warm up time with poles or recruiting people who have previously used walking poles could potentially yield different postural and gait speed results.

Although the outcome focus of this study was on gait speed and posture changes, 46% of participants expressed a feeling of improved balance while using walking poles. Balance, while not being one of the domains focused on in this research study, is a possible area of focus for continuing research. Two subjects were fitted using a balance technique. This was done by placing the tips of the walking poles at the front of their feet as opposed to at their heels. This improved their flow of ambulation dramatically and they were able to perform a smooth reciprocal movement without error. This technique is usually done for an older population and used more for balance than true Nordic walking. Further research can be done comparing the Nordic walking fitting technique to the balance fitting technique.

Results show that many of the participants had unchanged posture. However, since many of the participants already had good posture, there were no to little improvements to be achieved. When a decline in posture was noted, it was usually due to the fact that the participants were looking down while using the walking poles. This regression may have been due to discomfort with use of the poles due to an inadequate warm-up time, change in surfaces, fear of tripping, or lack of coordination. Future studies may take this into consideration and implement a longer period of warm-up over multiple surfaces. A study by Dalton and Nantel[8] used an eight-week training program to perfect the technique of walking poles before the data was collected. This allowed novice walking pole users to become more efficient and comfortable using the poles.

Following analysis of the research data, 11.7% of the participants improved their standing posture and 20.0% improved their walking posture while using walking poles. Though this may not be a significant change, 43.4% of subjects reported that their posture improved. Perception of improved posture while using walking poles could lead to increases in their popularity in the future. As seen in the results, it cannot be concluded that walking poles directly improve posture. It can, however, be concluded that there is a significant impact on the perception of their benefit in this domain. Psychological benefits should not be neglected when determining the effects of walking poles, as seen with these results. Individuals who desire a feeling of safety with increased balance or a more upright posture may benefit from walking pole use. This could be determined with further research focusing specifically on psychological effects. Other future studies can look at the effects of walking poles versus other adaptive equipment. Since posture did not regress while using the walking poles, this could be considered a positive outcome when looking at other assistive devices.

Limitations

There were several limitations involved in this study. First, the study was completed on two separate days with two separate age groups. Possible differences during the two days include setup of the iPad could have been skewed, leading to inconsistent views of the pictures. Secondly, the warm-up was done outside the study room to allow more space for participants. The patients trialed the walking poles in a "community" setting, while the actual study was done in a closed, smaller quieter environment.. The warm-up was also performed on a carpeted surface while the 10 MWT performed in the study area was on a tile surface. Lastly, some participants then had to walk more times than others due to a glitch in the GAITRite walkway sensors. The GAITRite walkway had the sensor boxes on the top which could have been a distraction to participants if they were focused on not hitting the boxes with their poles. This was demonstrated in the video recording of participants of head-down posture when walking over the GAITRite walkway. This study also did not use video-recording on the 10 MWT, so there was inability to compare posture with poles walking on the floor with no distractions.

For posture analysis with use of Hudl Technique, some subjects wore loose clothing and had hair down, covering major reference points, making it difficult to analyze changes in posture. Also, with standing photos the subjects were allowed to walk away from grid to set down poles between photos, possibly changing stance position. Subjects independently chose where to stand in front of the grid rather than the researcher setting up footprints of where exactly to stand. The number of steps and stage in the gait cycle could also alter the participant's head position. After a couple cycles of gait, participants may have felt more comfortable with the poles, decreasing the need to look down. Additionally, the iPads are also slightly outdated and this may have affected the capturing/viewing process as they are somewhat slow in processing images.

Recommendations

Recommendations for future studies would include, having subjects wear halter tops and shorts, with hair up and away from the face would allow for better/more accurate analysis of posture. Additionally, marking references points on the participants such as the greater trochanter and/or the acromion would be beneficial when analyzing posture. Having a marked line on the wall should also be included in order for increased similarities as to where the subjects look when having their photo taken, decreasing differences in looking down. With the use of the posture grid, exact heights (5'0", 5,1", 5'2" etc.) should be labeled at locations on the grid in order to better analyze changes in posture. Another recommendation would include the use of Posture Screen Mobile® application over Hudl as this app allows for better analysis and a more accurate measure of posture.[28] In future studies, the use of a fear of falling scale could be incorporated into the survey process for older individuals. In order to obtain a more natural walking pattern both with and without poles, the 10 MWT and GAITRite can be placed on a longer track to give increased time for acceleration and therefore a normal gait speed. This would better represent their normal walking speed and posture as they would have time to develop a comfortable and natural rhythm. Lastly, increasing the three minute warm up time with the walking poles, have the participants use them for a few weeks to be more comfortable in using walking poles.

Suggestions for Future Studies

Following this research, some recommendations for further research include: looking at other assistive devices and comparing them to walking poles, comparing other ages, completing studies with participants with pathological impairments instead of healthy individuals, and completing studies in other environments such as outdoors or in a community mall.[30]

CHAPTER V

CONCLUSION

This study showed that posture and gait speed did not significantly change with the use of walking poles. This was evident by gait speed not having a significant mean change with the use of walking poles compared to normal walking without poles. Also, evident by absence of significant statistical changes in overall participants posture as rated by researchers. In contrast, research by Dalton and Nantel[8] concluded that there was an increase of gait speed and more of an upright posture with the use of walking poles. Advanced technology was used to help measure gait speed and posture in order to show more precision with results. Six monitors were placed on the body to measure and analyze posture. In comparison to our study, posture changes were analyzed with only visual observation (photos/video) by the researchers. Also, Dalton and Nantel[8] study had participants train with walking poles for eight-weeks as compared to a three minute warm-up in our study. Indicating, it may be necessary for novice walking pole users to practice for a longer period to perfect their technique and for optimal benefits to occur.

The results of our study can be interpreted in a positive way, that walking pole use did not have a significant negative impact on gait speed or posture. Assistive devices, such as walkers or canes, can decrease gait speed and make posture worse. Walking poles may be a good alternative option for individuals who require or desire the use of an assistive device for ambulation while maintaining their current posture and gait speed. The high percentage of participants in our study, who perceived posture improvements with walking poles, may indicate walking poles might become a highly desirable assistive device in the future.

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APPENDIX A

UND UNIVERSITY OF NORTH DAKOTA

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DIVISION OF RESEARCH & ECONOMIC DEVELOPMENT

Institutional Review Board
Twamley Hall, Room 106
264 Centennial Dr Stop 7134
Grand Forks, ND 58202-7134
Phone: 701.777.4279
Fax: 701.777.6708
Email: UND.irb@research.UND.edu

April 19, 2017

Principal Investigator:	Meridee Danks, PT, DPT, NCS; Beverly Johnson, PT, DSc, GCS
Project Title:	Effects of Walking Poles on Posture and Gait
IRB Project Number:	IRB-201704-316
Project Review Level:	Expedited 4, 6
Date of IRB Approval:	04/19/2017
Expiration Date of This Approval:	04/18/2018
Consent Form Approval Date:	04/19/2017

The application form and all included documentation for the above-referenced project have been reviewed and approved via the procedures of the University of North Dakota Institutional Review Board.

Attached is your original consent form that has been stamped with the UND IRB approval and expiration dates. Please maintain this original on file. ***You must use this original, stamped consent form to make copies for participant enrollment. No other consent form should be used.*** It must be signed by each participant prior to initiation of any research procedures. In addition, each participant must be given a copy of the consent form.

Prior to implementation, submit any changes to or departures from the protocol or consent form to the IRB for approval. No changes to approved research may take place without prior IRB approval.

You have approval for this project through the above-listed expiration date. When this research is completed, please submit a termination form to the IRB. If the research will last longer than one year, an annual review and progress report must be submitted to the IRB prior to the submission deadline to ensure adequate time for IRB review.

The forms to assist you in filing your project termination, annual review and progress report, adverse event/unanticipated problem, protocol change, etc. may be accessed on the IRB website: http://und.edu/research/resources/human-subjects/

Sincerely,

Michelle L. Bowles

Michelle L. Bowles, M.P.A., CIP
IRB Coordinator

MLB/sb
Enclosures

Cc: Chair, Physical Therapy

University of North Dakota Human Subjects Review Form
January 2015 Version

All research with human participants conducted by faculty, staff, and students associated with the University of North Dakota, must be reviewed and approved as prescribed by the University's policies and procedures governing the use of human subjects. It is the intent of the University of North Dakota (UND), through the Institutional Review Board (IRB) and Research Development and Compliance (RD&C), to assist investigators engaged in human subject research to conduct their research along ethical guidelines reflecting professional as well as community standards. The University has an obligation to ensure that all research involving human subjects meets regulations established by the United States Code of Federal Regulations (CFR). When completing the Human Subjects Review Form, use the "IRB Checklist" for additional guidance.

Please provide the information requested below. Handwritten forms are not accepted – responses must be typed on the form.

Principal Investigator: Meridee Danks and Beverly Johnson

Telephone: 701-777-3861/701-777-2381 E-mail Address: meridee.danks@med.und.edu

Complete Mailing Address: 1301 N Columbia Rd Stop 9037, Grand Forks, ND 58202-9037

School/College: School of Medicine and Health Sciences Department: Physical Therapy

Student Advisor (if applicable): ____________________

Telephone: ____________________ E-mail Address: ____________________

Address or Box #: ____________________

School/College: ____________________ Department: ____________________

**** **All IRB applications must include a** Key Personnel Listing.*

Project Title: Effects of Walking Poles on Posture and Gait

Proposed Project Dates: Beginning Date: April 21, 2017 Completion Date: April 21, 2019
(Including data analysis)

Funding agencies supporting this research: NA

Did the grant proposal with the funding entity go through UND Grants & Contracts Admin.? ☐ YES or ☒ NO
Attach a copy of the grant proposal. Do not include any budgetary information. The IRB will not be able to review the study without a copy of the grant proposal submitted to the funding agency.

☐ YES or ☒ NO Does any researcher associated with this project have an economic interest in the research, or act as an officer or a director of any outside entity whose financial interests would reasonably appear to be affected by the research? If yes, submit on a separate piece of paper an additional explanation of the financial interest. The Principal Investigator and any researcher associated with this project should have a Financial Interests Disclosure Document on file with their department.

☐ YES or ☒ NO Will any research participants be obtained from another organization outside the University of North Dakota (e.g., hospitals, schools, public agencies, American Indian tribes/reservations)?

☐ YES or ☒ NO Will any data be collected at or obtained from another organization outside the University of North Dakota?

If yes to either of the previous two questions, list all organizations:

Letters from each organization must accompany this proposal. Each letter must illustrate that the organization understands its involvement and agrees to participate in the study. Letters must include the name and title of the individual signing the letter and should be printed on organizational letterhead.

Does any external site where the research will be conducted have its own IRB? ☐ YES ☐ NO ☒ N/A

If yes, does the external site plan to rely on UND's IRB for approval of this study? ☐ YES ☐ NO ☒ N/A
(If yes, contact the UND IRB at 701 777-4279 for additional requirements)

If your project has been or will be submitted to other IRBs, list those Boards below, along with the status of each proposal.

_______________ Date submitted: _______ Status: ☐ Approved ☐ Pending

_______________ Date submitted: _______ Status: ☐ Approved ☐ Pending

(include the name and address of the IRB, contact person at the IRB, and a phone number for that person)

Type of Project: Check "Yes" or "No" for each of the following.

☒ YES or ☐ NO New Project

☐ YES or ☐ NO Dissertation/Thesis/Independent Study

☐ YES or ☐ NO Continuation/Renewal

☐ YES or ☐ NO Student Research Project

☐ YES or ☐ NO Is this a Protocol Change for previously approved project? If yes, submit a signed Protocol Change Form, along with a signed copy of this form with the changes bolded or highlighted.

☐ YES or ☐ NO Does your project involve abstracting medical record information? If yes, complete the HIPAA Compliance Application and submit it with this form.

☐ YES or ☐ NO Does your project include Genetic Research?

Subject Classification: This study will involve subjects who are in the following special populations: Check all that apply.

☐ Children (< 18 years)

☒ UND Students

☐ Prisoners

☐ Pregnant Women/Fetuses

☐ Cognitively impaired persons or persons unable to consent

☐ Other _______________

Please use appropriate checklist when children, prisoners, pregnant women, or people who are unable to consent will be involved in the research.

This study will involve: Check all that apply.

☐ Deception (Attach Waiver or Alteration of Informed Consent Requirements)

☐ Stem Cells

☐ Radiation

☐ Discarded Tissue

☐ New Drugs (IND) IND # _______ Attach Approval

☐ Fetal Tissue

☐ Investigational Device Exemption (IDE) # _______ Attach Approval

☐ Human Blood or Fluids

☐ Non-approved Use of Drug(s)

☐ Other _____

☒ None of the above will be involved in this study

I. Project Overview

Please provide a brief explanation (limit to 200 words or less) of the rationale and purpose of the study, introduction of any sponsor(s) of the study, and justification for use of human subjects and/or special populations (e.g., vulnerable populations such as children, prisoners, pregnant women/fetuses).

Walking poles have been recently researched for their aerobic effects as well as the modifications they make to pressure patterns on the foot during ambulation. The purpose of our study is to determine the effects of walking pole use on posture and gait mechanics of healthy subjects. The use of bilateral walking poles will be compared to no assistive device. We hypothesize that the use of bilateral walking poles will improve posture and gait mechanics. Parameters of gait mechanics that we will focus on include step length, stride length, and walking speed. The results of this study will be used to further our knowledge about the effectiveness of walking poles and further research can be done to compare them to alternative assistive devices.

II. Protocol Description

Please provide a thorough description of the procedures to be used by addressing the instructions under each of the following categories.

1. **Subject Selection.**

a) Describe recruitment procedures (i.e., how subjects will be recruited, who will recruit them, where and when they will be recruited and for how long) and include copies of any advertisements, fliers, etc., that will be used to recruit subjects.

The subjects will be recruited by word of mouth by the research group and advisors. They will be recruited within the University of North Dakota School of Medicine and Health Sciences building and surrounding local community. This will take place pending IRB approval. Recruitment will take place until the goal of estimated number of subjects is reached.

b) Describe your subject selection procedures and criteria, paying special attention to the rationale for including subjects from any of the categories listed in the "Subject Classification" section above.

Subjects will be healthy individuals who are independent community ambulators age 18 and older and are willing to participate in the research study.

c) Describe your exclusionary criteria and provide a rationale for excluding subject categories.

Exclusion criteria includes individuals who currently use an assistive device, are not a community ambulator, or have a recent injury or impairment within the past 3 months that would affect gait and/or use of walking poles, including, but not limited to, cardiovascular issues, lower or upper extremity impairments, etc.

d) Describe the estimated number of subjects that will participate and the rationale for using that number of subjects.

The goal is to recruit at least 30 subjects to participate in the research study in order for our results to be statistically significant.

e) Specify the potential for valid results. If you have used a power analysis to determine the number of subjects, describe your method.

The greater number of subjects > 30, the more likely potential for valid resultsNo power analysis used.

2. **Description of Methodology.**

a) Describe the procedures used to obtain informed consent.

Participants will be asked if they would like to participate in the study. If they are interested they will receive a written informed consent to review. Questions will be addressed and then signatures will be obtained. Each participant will receive a copy of informed consent.

b) Describe where the research will be conducted. Document the resources and facilities to be used to carry out the proposed research. Please note staffing, funding, and space available to conduct this research.

University of North Dakota Medical School; Advisor of research will be Meridee Danks and Beverly Johnson; funding up for further investigation will be sought from (NDAPTA) later this spring.

c) Indicate who will carry out the research procedures.

UND Physical Therapy Faculty members Meridee Danks DPT and Beverly Johnson PT, DSC with six Graduate Students assisting.

d) Briefly describe the procedures and techniques to be used and the amount of time that is required by the subjects to complete them.

Participants will begin with a short survey and then five minute trial of walking poles. Once participants have become comfortable with using the walking poles a posture eval with and without walking poles utilizing a grid and plumb line method will be performed. Next participants will complete a 10 Meter Walk Test with and without walking poles. Participants will then walk across a instrumented walkway (GaitRite) with and without poles while also being video recorded using an iPad. The walkway will assess gait parameters and speed. The Hudl application on iPad will be used to analyze the participants posture with walking. They will perform 3 trials with and without the walking poles for both the 10m Walk Test and GaitRite. Participants will be asked to complete a brief survey about his/her opinions of the use of walking poles.

i. 10 Meter Walk Test- 10 meters are measured out, the first and last two meters are not timed. The assessor will begin timing at 2 meters and end time at 8 meters. Participants will be instructed to walk at a comfortable walking speed. Test will be administered with and without poles 3 times.

ii. GaitRite- A 3"x18" electronic mat that measures numerous components of gait.

e) Describe audio/visual procedures and proper disposal of tapes.

Video will be taken during GaitRite examination and a photo during posture evaluation with and without poles. Video and photo used for posture evaluation. Consent form will have an additional signature for permission to photograph and video tape during the study.

f) Describe the qualifications of the individuals conducting all procedures used in the study.

Meridee Danks has been a practicing physical therapist for 33 years and has a specialty certification in Neurological Physical Therapy. Bev Johnson has been a practicing physical therapist for 35+ years and has a Doctoral of Science in Geriatrics. UND PT Students will be supervised and trained as needed.

g) Describe compensation procedures (payment or class credit for the subjects, etc.).

Participants will be put in a drawing for a chance to receive a pair of walking poles following completion of research. A single pair of walking poles will be given out.

Attachments Necessary: Copies of all instruments (such as survey/interview questions, data collection forms completed by subjects, etc.) must be attached to this proposal.

3. Risk Identification.

a) Clearly describe the anticipated risks to the subject/others including any physical, emotional, and financial risks that might result from this study.

There is a minimal risk of losing balance or falling during gait analysis. Only subjects that are healthy and community ambulators are being allowed to participate. The subject will be instructed that they are able to quit the activity at any time if they do not feel safe.

b) Indicate whether there will be a way to link subject responses and/or data sheets to consent forms, and if so, what the justification is for having that link.

There will be no link between data sheets and consent forms.

c) Provide a description of the data monitoring plan for all research that involves greater than minimal risk.

N/A

d) If the PI will be the lead-investigator for a multi-center study, or if the PI's organization will be the lead site in a multi-center study, include information about the management of information obtained in multi-site research that might be relevant to the protection of research participants, such as unanticipated problems involving risks to participants or others, interim results, or protocol modifications.

N/A

4. Subject Protection.

a) Describe precautions you will take to minimize potential risks to the subjects (e.g., sterile conditions, informing subjects that some individuals may have strong emotional reactions to the procedures, debriefing, etc.).

We will ensure a safe environment with limited distractions, adequate space, and a clear walking path without obstacles. Subjects will be informed that they are able to stop any activity they do not feel safe performing. All walking activity will be directly supervised by research personnel.

b) Describe procedures you will implement to protect confidentiality and privacy of participants (such as coding subject data, removing identifying information, reporting data in aggregate form, not violating a participants space, not intruding where one is not welcome or trusted, not observing or recording what people expect not to be public, etc.). If participants who are likely to be vulnerable to coercion and undue influence are to be included in the research, define provisions to protect the privacy and interests of these participants and additional safeguards implemented to protect the rights and welfare of these participants.

All data will be coded and identifying information will be removed once all data is gathered. Any reporting will be an aggregate form.

c) Indicate that the subject will be provided with a copy of the consent form and how this will be done.

Each subject will be provided with a copy of the consent form prior to participation.

d) Describe the protocol regarding record retention. Please indicate that research data from this study and consent forms will both be retained in separate locked locations for a minimum of three years following the completion of the study.
Describe: 1) the storage location of the research data (separate from consent forms and subject personal data)
2) who will have access to the data
3) how the data will be destroyed
4) the storage location of consent forms and personal data (separate from research data)
5) how the consent forms will be destroyed

1. The research data will be stored separately from the consent form and other personal data
2. Only researchers will have access to the data.
3. The data will be kept a minimum of three years and will be shredded once data analysis is completed.
4. Consent forms or personal data will be stored in separate files in a locked office of the researcher.
5. Consent forms will be kept a minimum of three years and will be shredded once data analysis is completed.

e) Describe procedures to deal with adverse reactions (referrals to helping agencies, procedures for dealing with trauma, etc.).

Suggestions to contact a physician will be made if subjects have any concerns.

f) Include an explanation of medical treatment available if injury or adverse reaction occurs and responsibility for costs involved.

Subject will be referred for medical treatment if required for any injury that may occur during assessment. The responsibility of cost related to any treatment will be the responsibility of the subject.

III. Benefits of the Study

Clearly describe the benefits to the subject and to society resulting from this study (such as learning experiences, services received, etc.). **Please note:** extra credit and/or payment are not benefits and should be listed in the Protocol Description section under Methodology.

Subjects will be able to have their posture and gait assessed at no cost. They will also be able to experiment with walking poles. They will be able if there is any benefit of using walking poles to improve their posture and gait. The research will provide benefit to the general society by seeing the effectiveness of walking poles on posture and gait.

IV. Consent Form

Clearly describe the consent process below and be sure to include the following information in your description (Note: Simply stating 'see attached consent form' is not sufficient. The items listed below must be addressed on this form.):

1) The person who will conduct the consent interview
2) The person who will provide consent or permission
3) Any waiting period between informing the prospective participant and obtaining consent
4) Steps taken to minimize the possibility of coercion or undue influence
5) The language (English, French, German, etc.) to be used by those obtaining consent
6) The language (English, French, German, etc.) understood by the prospective participant or the legally authorized representative
7) The information to be communicated to the prospective participant or the legally authorized representative

1. Meridee Danks and Bev Johnson will supervise the informed consent interview.
2. The individual that is volunteering for the study.

3. Participants will be given the consent form to read and allowed to ask any questions prior to obtaining consent.
4. Prospective subjects will be told research is voluntary and if they do participate that they will be able to stop at any time without any penalty
5. English
6. English
7. The consent form will indicate the assessments to be performed and the amount of time to perform them and who will be performing the assessments.

A copy of the consent form must be attached to this proposal. If no consent form is to be used, document the procedures to be used to protect human subjects, and complete the Application for Waiver or Alteration of Informed Consent Requirements. Refer to form IC 701-A, Informed Consent Checklist, and make sure that all the required elements are included. **Please note:** All records attained must be retained for a period of time sufficient to meet federal, state, and local regulations; sponsor requirements; and organizational policies. The consent form must be written in language that can easily be read by the subject population and any use of jargon or technical language should be avoided. **The consent form should be written at no higher than an 8th grade reading level** and must be written in the second person (please see the example on the RD&C website). A two inch by two inch blank space must be left on the bottom of each page of the consent form for the IRB approval stamp.

Necessary attachments:

- ☒ Signed Student Consent to Release of Educational Record Form (students and medical residents only);
- ☒ Investigator Letter of Assurance of Compliance; (all researchers)
- ☒ Consent form, or Waiver or Alteration of Informed Consent Requirements (Form IC 702-B)
- ☒ Key Personnel Listing
- ☒ Surveys, interview questions, etc. (if applicable);
- ☐ Printed web screens (if survey is over the Internet); and
- ☐ Advertisements (flyer, social media postings, email/letters, etc.).

By signing below, you are verifying that the information provided in the Human Subjects Review Form and attached information is accurate and that the project will be completed as indicated.

Signatures:

(Principal Investigator) Date: 4-9-17

(~~Student Advisor~~) Date: 4-9-17

*****All students and medical residents must list a faculty member as a student advisor on the first page of the application and must have that person sign the application.*****

Requirements for submitting proposals:

Additional information can be found on the IRB website at: http://und.edu/research/resources/human-subjects/index.cfm

Original, signed proposals and all attachments, along with the necessary number of copies (see below), should be submitted to: Institutional Review Board, 264 Centennial Drive Stop 7134, Grand Forks, ND 58202-7134, or brought to Room 106, Twamley Hall.

Required Number of Copies:

- Expedited Review: Submit the signed original and 1 copy of the entire proposal.
- Full Board Review: Submit the signed original and 22 copies of the entire proposal by the deadline listed on the IRB website: http://und.edu/research/resources/human-subjects/meeting-schedule.cfm
- Clinical Medical Subcommittee and Full Board Review: Submit the signed original and 24 copies of the entire proposal by the deadline listed on the IRB website: http://und.edu/research/resources/human-subjects/meeting-schedule.cfm

Prior to receiving IRB approval, researchers must complete t[illegible]uired IRB human subjects' education. Please go to:

North Dakota Physical Therapy Association

North Dakota Physical Therapy Association
Department of Physical Therapy Suite E321
School of Medicine and Health Sciences
University of North Dakota
1301 North Columbia Road, Stop Box 9037
Grand Forks, ND 58202-9037

Meridee Danks, PT, DPT, NCS
University of North Dakota
Department of Physical Therapy Suite E321
School of Medicine and Health Sciences
University of North Dakota
1301 North Columbia Road, Stop Box 9037
Grand Forks, ND 58202-9037

Dear Meridee,

Thank you for submitting an application for the North Dakota Physical Therapy Association's research stipend with your project "Effects of Walking Poles on Posture and Gait Mechanics." We strive to promote the field of physical therapy in our state and feel that clinical research such as yours contributes significantly to achieving this goal. **We are excited to announce that you will receive funding for your project in the amount of $360.00.**

If you decide to accept the funding from the NDPTA, we ask that a comment be made on the publication regarding partial funding received from our organization. At least 1 member of your group will be required to present the research at an NDPTA meeting upon completion of your project. The treasurer will be send out a check with the next few weeks. Please let me know if you have any questions. Congratulations!

Sincerely,

Scott Brown/PH

Scott Brown, PT, DPT, OCS, SCS
NDPTA Vice President

APTA
American Physical Therapy Association

APPENDIX B

THE UNIVERSITY OF NORTH DAKOTA
CONSENT TO PARTICIPATE IN RESEARCH

TITLE:	Effects of Walking Poles on Posture and Gait
PROJECT DIRECTOR:	*Meridee Danks, Beverly Johnson*
PHONE #	*701-777-3861 or 701-777-3871*
DEPARTMENT:	*Physical Therapy*

STATEMENT OF RESEARCH

A person who is to participate in the research must give his or her informed consent to such participation. This consent must be based on an understanding of the nature and risks of the research. This document provides information that is important for this understanding. Research projects include only subjects who choose to take part. Please take your time in making your decision as to whether to participate. If you have questions at any time, please ask.

WHAT IS THE PURPOSE OF THIS STUDY?

You are invited to be in a research study about the use of walking poles and its effects on gait mechanics and posture because you are contributing to research to determine if walking poles can be used to benefit gait mechanics and posture in healthy, community ambulators.

The purpose of this research study is to determine the effects of walking pole use on posture and gait mechanics on healthy subjects.

HOW MANY PEOPLE WILL PARTICIPATE?

Approximately 50 people will take part in this study at the University of North Dakota.

Your participation in the study will last about 20 minutes. You will need to visit PT department at the University of North Dakota Medical School one time to complete the study.

WHAT WILL HAPPEN DURING THIS STUDY?

As a participant in this study, you will enter the room and be given a demographic survey. You will then be fitted for walking poles, given instructions in proper use and then will practice with the poles for 5 minutes. Following warm up, participant will go to three stations that consist of a Timed 10-meter Walk test, posture analysis, and a walk across an instrumented walkway (GAITRite) that records footprints and walking measures. Pictures and videos using an iPad will be taken at these stations in order to allow for posture and gait analysis. Prior to finishing, you will fill out a walking pole survey prior to finishing.

WHAT ARE THE RISKS OF THE STUDY?

There is no more than a minimal risk of losing balance or falling during gait analysis. Risk will be minimized by providing proper instructions in use of walking poles, allowing time to practice using the walking poles prior to testing and having research assistance spotting during all walking activities. You will be instructed that you are able to quit the activity at any time if you feel unsafe.

WHAT ARE THE BENEFITS OF THIS STUDY?

You may not benefit personally from being in this study. However, we hope that, in the future, other people might benefit from this study because they find the use of walking poles improves their posture, gait speed, and gait mechanics.

WILL IT COST ME ANYTHING TO BE IN THIS STUDY?

You will have zero costs for being in this research study.

WILL I BE PAID FOR PARTICIPATING?

You will not be paid for participating in this research study. Your name will be entered in a drawing for a free pair of walking poles for participation.

CONFIDENTIALITY

The records of this study will be kept private to the extent permitted by law. In any report about this study that might be published, you will not be identified. Your study record may be reviewed by Government agencies and the University of North Dakota Institutional Review Board.

Any information that is obtained in this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Pictures and videos using iPads will be taken in this study for postural analysis and gait mechanics. These pictures will be used for collecting postural data during the study. If we write a report or article about this study, we will describe the study results in a summarized manner so that you cannot be identified. Permission to use these pictures or videos for future research or analysis will be asked for prior to use.

IS THIS STUDY VOLUNTARY?

Your participation is voluntary. You may choose not to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Your decision whether or not to participate will not affect your current or future relations with the University of North Dakota. There will be no penalty if you choose not to participate in this study.

CONTACTS AND QUESTIONS?

The researchers conducting this study are Meridee Danks, Beverly Johnson, and student research assistants. You may ask any questions you have now. If you later have questions, concerns, or complaints about the research please contact Meridee Danks or Beverly Johnson at 701-777-3861 during the day. If you have questions regarding your rights as a research subject, you may contact The University of North Dakota Institutional Review Board at **(701) 777-4279** or UND.irb@research.UND.edu.

- You may also call this number about any problems, complaints, or concerns you have about this research study.
- You may also call this number if you cannot reach research staff, or you wish to talk with someone who is independent of the research team.
- General information about being a research subject can be found by clicking "Information for Research Participants" on the web site: http://und.edu/research/resources/human-subjects/research-participants.cfm

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Subjects Name (Printed):

____

____________________________________ ______________

Signature of Subject Date

I have discussed the above points with the subject or, where appropriate, with the subject's legally authorized representative.

____________________________________ ______________

Signature of Person Who Obtained Consent Date

I give consent to be video recorded and photographed during this study.

Please initial: ____ Yes ____ No

APPENDIX C

Walking Pole Survey

Age_____ Height ___ft ____in

1. Do you have any history of injury or impairment that has affected your walking ability?

   Yes No

   If yes, please list:

2. Have you used walking poles prior to this study? Yes No

3. Do you currently have difficulty walking? Yes No

4. Rank how easy was it to walk with walking poles. 0-10, 0 being easy, 10 being very difficult

   0 1 2 3 4 5 6 7 8 9 10

5. Rank your posture without walking poles. 0-10, 0 being poor, 10 being ideal.

   0 1 2 3 4 5 6 7 8 9 10

6. Rank your posture with walking poles. 0-10, 0 being poor, 10 being ideal.

   0 1 2 3 4 5 6 7 8 9 10

7. Do you personally feel as though there are benefits to using walking poles?

   Yes No

   If yes, please list:

8. If you were to use walking poles, where would you use them?

9. Do you feel the walking poles help your balance? Yes No Not Applicable

Additional comments: