PRE-OP FUNCTIONAL DIFFERENCES IN KNEE ARTHROPLASTY PATIENTS

ASSESSMENT OF PRE-OPERATIVE FUNCTIONAL DIFFERENCES IN PATIENTS UNDERGOING TOTAL AND PARTIAL KNEE ARTHROPLASTIES

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TITLE: Assessment of Pre-Operative Functional Differences in Patients Undergoing Total and Partial Knee Arthroplasties

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Abstract

Background: Osteoarthritis (OA) is a prevalent joint disease causing significant disability, particularly in the knee often treated end-stage with joint replacement surgery. While partial knee arthroplasty (PKA) is noted for quicker recovery and better functionality compared to total knee arthroplasty (TKA), its underutilization highlights a gap in surgical decision-making, driven by a lack of objective data on pre-operative functional differences.

Methods: This prospective observational study, conducted from November 2023 to April 2024 at St. Joseph's Healthcare Hamilton, included 34 end-stage OA patients scheduled for knee arthroplasty. Participants underwent pre-operative functional assessments using markerless motion capture technology to analyze gait and mobility during walking and sit-to-stand tests.

Results: The study found no significant differences in basic gait and sit-to-stand metrics between the PKA and TKA groups at a preferred pace. However, at a faster pace, PKA patients demonstrated greater adaptability, showing significant increases in peak stance knee flexion, knee flexion excursions, and stride length, compared to TKA patients whose gait patterns remained consistent across speeds.

Conclusion: PKA patients exhibit greater functional adaptability in their pre-operative state, suggesting potential underestimation of their capabilities in current surgical evaluations. Incorporating varied-pace walking tests in pre-operative assessments may provide deeper insights into functional capabilities, influencing more tailored surgical decisions and potentially increasing the application of PKA in suitable candidates.

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List of all Abbreviations and Symbols

HIREB: Hamilton Integrated Research Ethics Board

OA: Osteoarthritis

OKS: Oxford Knee Score

PKA: Partial Knee Arthroplasty

REDCap: Research Electronic Data Capture

ROM: Range of Motion

TKA: Total Knee Arthroplasty

Declaration of Academic Achievement

I, Fatima Gafoor, hereby declare that I am the sole author of this thesis. This study was conceived by Fatima Gafoor and Dr. Dylan Kobsar. Edits and revisions were conducted by Fatima Gafoor, based on feedback provided by Dr. Dylan Kobsar, Dr. Anthony Adili, Dr. Peter Keir, Dr. Kim Madden, Dr. Vincenzo E. Di Bacco, and Matthew Ruder.

1. Background

Arthritis is a common and painful set of joint diseases which affects 20% of Canadians and nearly 50% of Canadians over 65 years of age (Arthritis Society Canada). Osteoarthritis (OA), the most common form of arthritis, impacts the entire joint including the bone, cartilage, ligaments, fat, and the synovium causing in pain, stiffness, and a loss of mobility (Litwic et al., 2013). This is especially true for knee OA which is the most common form of OA (Litwic et al., 2013). Risk factors associated with knee OA include age, biological sex, obesity, previous joint injuries, and a sedentary lifestyle (Palazzo et al., 2016). Treatments for knee OA include physical therapy, weight loss, and bracing, complemented by NSAIDs, corticosteroid and hyaluronic acid injections, and various other adjunctive medicines (Katz et al., 2021; DeRogatis et al., 2019). When these interventions are ineffective or if a person has reached end-stage knee OA, knee arthroplasty may be performed. This surgical procedure aims to relieve pain and partially restore function by replacing the articular surfaces of the joint with prosthetic components (Gress et al., 2020). In Canada, knee arthroplasties are the fourth most common surgery performed (Canadian Institute for Health Information).

Patients most commonly undergo a total knee arthroplasty (TKA), where all compartments of the knee (e.g., medial, lateral, and patellofemoral) are replaced. However, in cases where damage is localized to a single compartment, a partial knee arthroplasty (PKA), also known as a unicompartmental knee arthroplasty, may be performed. PKAs are noted for quicker recovery, less post-operative pain, and a better range of motion and functionality than TKAs (Willis-Owen et al., 2009). Research also suggests PKAs are more cost-effective than a TKA in the long-term, as they offer greater health benefits and lower healthcare costs, including the cost of the surgery as well as the subsequent healthcare use (Beard et al., 2020; Willis-Owen et al., 2009). In fact, in the United States, a study found the costs of hospital stay and the implant for a PKA were approximately $4,000 and $1,500 USD less, respectively (Shankar et al., 2016). Furthermore, because more bone is preserved in a PKA, patients have reported that a PKA feels more natural than a TKA (Pumilia et al., 2021). While PKAs offer advantages such as faster recovery and improved function, they may have shorter lifespans than TKAs (Chawla et al., 2017).

Despite the numerous benefits of PKA, there remains a significant discrepancy between the number of individuals potentially eligible for PKA and those who actually receive this surgical intervention instead of a TKA. In the UK, for instance, PKAs account for only 8% of all knee replacements, though about 50% of patients may be eligible (Smith et al., 2020). This discrepancy suggests that as many as 50,000 patients annually face the decision between partial and total knee arthroplasty in the UK alone (Smith et al., 2020). Several factors contribute to this gap, including the technical challenges associated with performing PKAs, which often require robot-assisted technology. This technology can be prohibitively expensive and difficult to implement in existing operating rooms (Lawrie et al., 2022). Additionally, more standardized methods may be necessary to better identify those who would benefit most from a PKA rather than a TKA.

The protocol for assessing a patient's eligibility for PKA has evolved alongside advancements in surgical methods. Although pain is typically measured preoperatively and postoperatively, relying solely on patient-reported pain levels to decide between a TKA and a PKA is problematic. Pain is inherently subjective and can be influenced by various factors, including a patient’s pain tolerance, psychological factors, and demographic factors, including age, sex, and comorbidity (Gandhi et al., 2010). Currently, the standard protocol for determining the most appropriate surgical approach primarily depends on radiographic assessments which may be supported by initial range of motion (ROM) assessments. These tests can serve as reference points for surgeons as they decide the most suitable course of action.

While radiographs are essential for assessing the structural severity of OA, they do not provide a comprehensive view of the disease state of OA. For example, certain types of knee damage to the knee may not be readily apparent on radiographs. Consequently, although radiographs might show limited tri-compartmental deterioration, suggestive of a PKA, more extensive damage might only be apparent during surgery, necessitating a switch to a TKA. Moreover, while some correlation has been observed between radiographic severity and knee pain (Neogi et al., 2009), this relationship is generally weak (Niwa et al., 2019; Goldring, 2009). Biomechanical studies support this, revealing that patients with the same radiographic grade can exhibit significant differences in three-dimensional knee joint kinematics (Astephen Wilson et al., 2017). Thus, although radiographic findings are valuable, they cannot capture the functional severity of the patient undergoing surgery.

While some studies have examined the post-operative functional differences between PKA and TKA (Leiss et al., 2020), data on pre-operative functional differences are lacking. Pre-operative knee ROM assessments can be conducted, but these alone may not provide substantial evidence regarding whether a patient should receive a TKA or a PKA. This can be because knee ROM is often assessed with a goniometer by a physician where the patient is lying in the supine position on an examination bed (Kittelson et al., 2020). They are prompted to flex and extend their knees when lying down. Rarely is pre-operative function extensively studied in relation to gait and daily function to support clinical decisions and surgical approaches. Furthermore, while preoperative function is sometimes assessed using self-report questionnaires like the 36-Item Short Form Health Survey or the Oxford Knee Score (OKS; Dust et al., 2023), these data are limited by recall bias and the potential for patients to consciously or unconsciously misrepresent their functionality in an effort to influence the outcomes perceived by researchers or clinicians. Therefore, incorporating more objective gait metrics could provide a more comprehensive overview of a patient's functional mobility, compared to standard range of motion (ROM) assessments and patient-reported survey data.

To enhance the assessment of functional mobility, researchers and clinicians can utilize motion capture technology in clinical settings to analyze patient gait. With the advent of markerless motion capture technology, these assessments become more feasible than conventional marker-based systems by eliminating the need for individual marker placement and long, manual data processing times. While markerless motion capture is not error-free, it has been shown to be comparable to marker-based systems under walking tasks when analyzing joint kinematics, including those of the knee, hip, and ankles (Riazati et al., 2022; Kanko et al., 2021; Wren et al., 2023). The minimal errors observed suggest it is a viable option for assessing kinematics in clinical settings, where traditional marker-based systems prove impractical.

Markerless motion capture facilitates comprehensive assessments of functional mobility, such as walking and sit-to-stand tests, crucial for evaluating physical function in OA (Dobson et al., 2013). Standard walking gait analysis is well-established to provide key metrics like walking speed, stride length, and knee flexion excursion in stance (McCarthy et al., 2013; Nagano et al., 2012). Introducing faster walking conditions may further highlight significant differences (McClelland et al., 2011). Additionally incorporating other functional tests, such as the sit-to-stand, can further evaluate broader aspects of function, including peak trunk flexion and time required to complete five repetitions (Turcot et al., 2012; Fu et al., 2021). Together, these tests have the potential to differentiate patients more suited for a PKA from those who might benefit from a TKA, yet these distinctions have not been thoroughly examined in existing literature.

2. Motivations

The motivations behind this study are to bridge the existing gap between the reported benefits of a PKA and its underutilization compared to TKA. Despite PKA suggested to offer advantages such as quicker recovery, reduced post-operative pain, and enhanced functionality, there is a lack of objective data surrounding the level of function and mobility that is seen both pre-operatively and post-operatively. Therefore, there is a dire need to objectively quantify the level of functional severity seen in individuals undergoing a PKA as compared to a TKA. Further, establishing a strong pre-operative foundation of these potential functional differences is the logical first step in understanding why post-operative improvements may differ. Further, there is a need to identify additional, objective metrics of gait and function which may offer insight for surgeons when deciding their surgical approach (TKA vs PKA) and optimize patient outcomes.

3. Research Question

Is there a significant difference in pre-operative functional mobility, as measured by an in-clinic 3D motion capture system, between patients who undergo a TKA and those undergoing a PKA?

4. Hypothesis

I hypothesize that preoperative assessments will reveal significant differences in functional mobility between patients that undergo TKAs and those undergoing PKAs, as TKA patients will likely exhibit more mobility limitations compared to PKA patients, reflecting a greater severity of joint degradation. More specifically, I expect TKA patients to exhibit reduced knee joint mobility as indicated by decreased knee flexion, an indicator of stiffness in the joint, as well as shorter step lengths, longer stride times, and reduced gait speed, compared to PKA candidates. Additionally, TKA patients will show increased duration to complete five repetitions of the sit-to-stand test, as well as increased peak trunk flexion.

I expect that patients undergoing PKAs should be more functional (e.g., greater peak knee flexion, reduced trunk flexion, etc.) than patients undergoing TKAs, but there is limited evidence available that has studied the pre-operative differences. Additionally, if one is aiming to examine post-operative success and improvements to pain and function, it is important to have a solid baseline to gauge improvements from. Developing a greater understanding of these pre-operative functional differences and evaluating function over time can support future work to optimize surgical implanting techniques and patient outcomes.

5. Methods

5.1 Study Design

This study utilized a prospective observational design to investigate the pre-operative functional assessments in patients that are scheduled for knee arthroplasty. Data collection started in November 2023 and is ongoing and will continue to occur with collaboration with the Orthopedic Research team St. Joseph’s Healthcare Hamilton. This study used data collected from November 2023 to April 2024 of patients receiving knee replacement surgery. This study has been reviewed and approved by the Hamilton Integrated Research Ethics Board (HIREB).

5.2 Participants

There were 34 individuals that participated in the study, with 8 PKA patients and 26 TKA patients. See Table 1 for participant demographics. The recruitment process took place at St. Joseph's Hamilton from the Fracture Clinic from November 2023 to April 2024. Eligible patients who are scheduled for a knee arthroplasty were informed about the study by the clinical and research staff during the patient's pre-op assessment visit approximately 1-2 weeks prior to surgery. Inclusion criteria include end-stage OA patients that are scheduled for a knee arthroplasty with Dr. Anthony Adili at St. Joseph's Healthcare Hamilton, ability to ambulate without any walking aids, and must have the ability to provide informed consent.

Table 1. Participant demographics and pain rating**s.**

	PKA (n = 8)	TKA (n = 26)
Mean Age (years)	57 (6)	67 (8)
Sex (% Female)	87% Female	65% Female
Mean BMI (kg/m^2)	30.8 (5.5)	32.0 (4.0)
Average Pain in Last Week (/10)	6.25 (1.91)	6.23 (1.68)
Average Pain in Last 24 Hours (/10)	6.38 (2.56)	6.11 (193)
Average Worst Pain in 24 Hours (/10)	7.50 (2.98)	7.58 (2.04)
Average Pain at Time of Data Collection (/10)	5.63 (3.02)	4.31 (2.68)

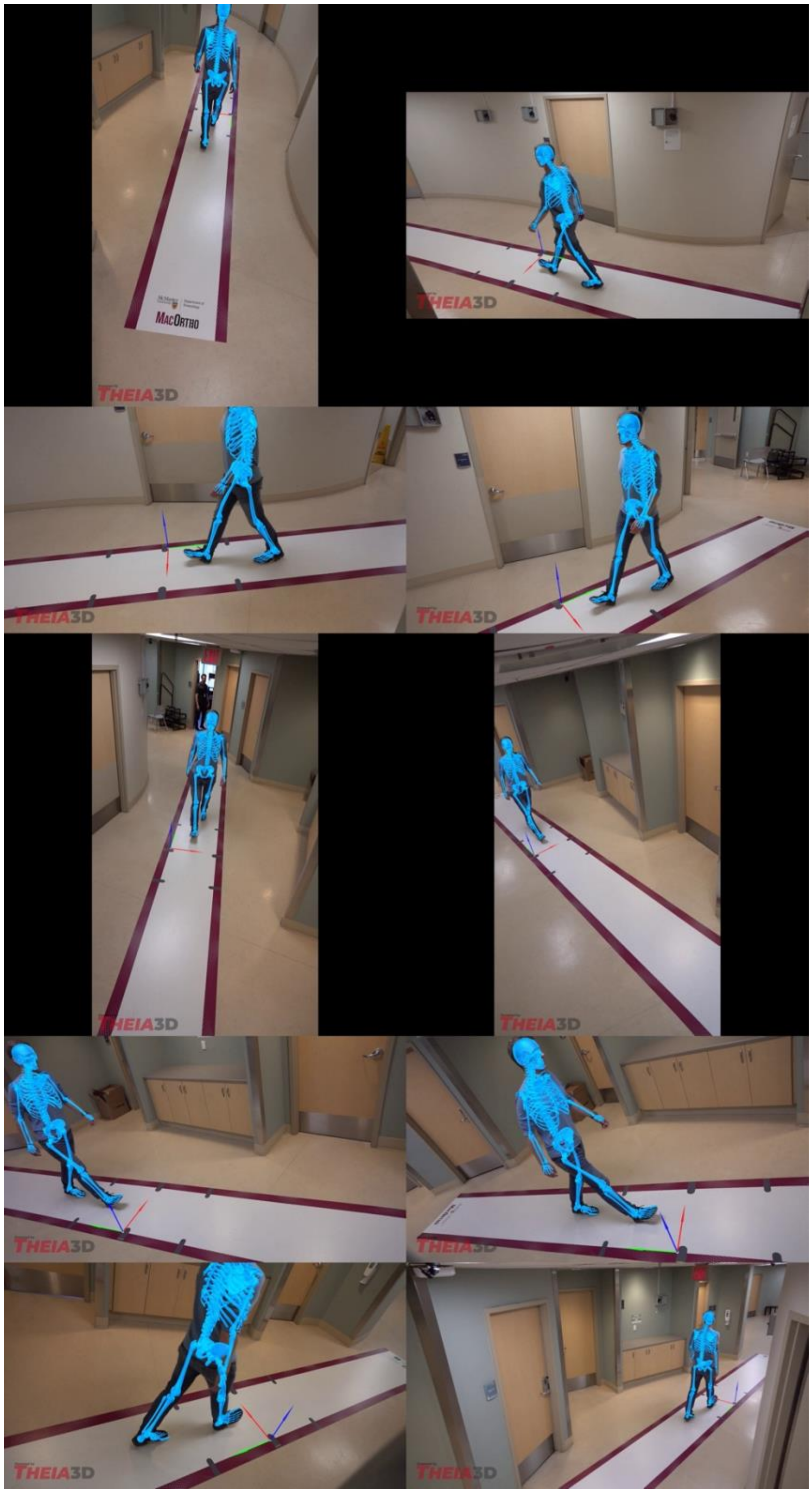

Figure 1. Visualization of a walk test at St. Joseph's Hamilton, recorded from ten synchronized cameras and processed with Theia3D.

5.3 Data Collection

Upon obtaining informed consent, patients were enrolled in the study and filled out a survey which records the patients' demographics, medical history, self-reported pain and self-reported function via OKS (Rolfson et al., 2016), quality of life (EQ-5D) (Bilbao et al., 2018), depression (PHQ-8) (Kroenke et al., 2009), and surgical expectations on an associated Research Electronic Data Capture (REDCap) survey. Following consent and the REDCap survey, patients completed the pre-operative functional assessments with motion capture technology. Ten Sony Cyber-shot DSC-RX0 II digital cameras were fitted in optimized locations throughout the orthopedic research hallway at St. Joseph's Healthcare Hamilton to capture data collected over a 25-foot decal. These cameras recorded synchronized data of participants performing functional tasks. These video recordings were then processed by Theia3D (Theia Markerless, Kingston, ON, Canada), a software which identifies and tracks the subject in the videos, and then were used to compute the 3D position and orientation of each segment of the tracked subjects.

A total of five tasks were completed to quantitatively examine address patient functional status. Firstly, i) patients were recorded standing still for 30 seconds with their arms crossed over their shoulders to assess static knee alignment. Following this, ii) they were asked to walk at their normal, preferred pace on the designated decal for 60 seconds, or until they complete six passes, whichever occurs first. Afterwards, iii) they were instructed to "walk at a pace faster than their usual pace" for 30 seconds. The patient was then be asked to perform iv) a five-repetition sit-to-stand test, followed by v) a stair ascent and descent task on a mobile set of stairs with two steps. It should be noted that not all patients were able to complete tasks. As such, walking data at the preferred pace was collected for all participants, but the additional function tests were only completed if the patients were functionally capable of doing so. Further, static alignment and stair ascent and decent data were not processed for this study.

5.4 Data Analysis

Video files were processed by Theia3D and the resulting 3D motion data (e.g., C3D files) were processed using Visual3D (C-Motion Inc., Kingston, ON) to obtain spatiotemporal parameters and joint kinematics for the gait and sit-to-stand assessments. Peak knee flexion angle (degrees) during the stance and swing phases, knee flexion excursion (degrees), and spatiotemporal parameters, which include stride length (m), gait speed (m/s), step width (m), were assessed for both self-selected and fast-paced gait trials. Knee flexion excursion was measured as difference between the peak stance knee flexion and the knee flexion at initial contact. For the sit-to-stand task, the mean time (s) taken to complete five repetitions of was assessed, as well as the peak knee and trunk flexion angles (degrees) for each repetition were assessed. Trunk flexion was chosen as a metric because less-functional adults have been shown to increase trunk flexion to provide a mechanical advantage and support their lower limbs when getting up from the chair (Hicks-Little et al., 2011).

5.5 Statistical analysis

A series of independent samples T-test with an alpha level of 0.05 was used to compare each preoperative functional metric between the TKA and PKA groups, which provided insight into whether significant differences in gait and functional metrics exist between the two groups. Additionally, the effect sizes of these variables were compared using a Cohen’s d. Effect sizes were used to examine the significance of the differences in functional metrics when comparing TKA and PKA patients. These were interpreted as follows: 0.2 to 0.5 indicated a small effect, 0.5 to 0.8 indicated a medium effect, and greater than 0.8 indicated a large effect.

6. Results

Each walking task (60s preferred pace and 30s fast-paced) was assessed separately, evaluating variables including knee flexion at initial contact, peak stance knee flexion, knee flexion excursion, peak swing knee flexion, gait speed, stride length, and stride width. When comparing PKA patients to TKA patients for each of these variables, no significant differences were found between the two groups for both the preferred pace and fast-paced walking tasks (p>0.05), as shown in Tables 2 and 3, respectively. For the sit-to-stand task, the mean time to complete 5 repetitions, peak knee flexion, and peak trunk flexion were compared between PKA and TKA patients, with no significant differences found between the two groups (p>0.05), as shown in Table 4.

However, when assessing the differences in walking metrics between the two paces (i.e., changes in gait metrics when going from preferred- and fast-paced gait), significant differences were found between PKA and TKA groups, as shown in Table 5. Specifically, it was shown that peak stance knee flexion (p<0.001; Cohen's d=1.22) and knee flexion excursion (p=0.002, Cohen's d=0.96) differences were significantly greater between the preferred and fast-paced conditions for the PKA group when compared to the TKA group. Similarly, stride length differences between conditions were significantly greater between walking conditions for the PKA when compared to the TKA group (p=0.038, Cohen's d=0.97). In other words, when asked to walk at a faster pace, PKA patients were more likely to show increases in stride length, peak stance knee flexion, and knee flexion excursion, whereas TKA patients' gait metrics showed limited differences between walking conditions.

Table 2. Gait metrics from the preferred pace walk showed no differences between groups.

	PKA	TKA	Mean Difference	p-value
Knee Flexion at initial contact (deg)	6.6 (2.4)	8.9 (4.2)	-2.2	0.07
Peak Stance Knee Flexion (deg)	18.5 (2.7)	20.5 (5.0)	-1.9	0.15
Knee Flexion Excursion (deg)	11.8 (2.3)	11.8 (3.9)	0.1	0.95
Peak Swing Knee Flexion(deg)	57.6 (12.8)	60.4 (6.8)	-2.8	0.57
Stride Length (m)	1.10 (0.16)	1.13 (0.18)	-0.03	0.67
Gait Speed (m/s)	0.93 (0.19)	0.96 (0.20)	-0.03	0.70
Stride Width (m)	0.14(0.03)	0.15 (0.03)	-0.01	0.55

Table 3. Gait metrics from the fast-paced walk showed no differences between groups.

	PKA	TKA	Mean Difference	p-value
Knee Flexion at initial contact (deg)	7.0 (2.9)	9.6 (4.4)	-2.6	0.07
Peak Stance Knee Flexion (deg)	21.6 (2.6)	21.9 (4.8)	-0.3	0.83
Knee Flexion Excursion (deg)	14.6 (2.8)	12.3 (4.1)	2.3	0.10
Peak Swing Knee Flexion (deg)	60.9 (10.0)	60.8 (5.4)	0.1	0.98
Stride Length (m)	1.29 (0.15)	1.24 (0.19)	0.05	0.51
Gait Speed (m/s)	1.25 (0.19)	1.22 (0.25)	0.02	0.78
Stride Width (m)	0.14 (0.03)	0.20 (0.27)	-0.06	0.29

Table 4. Sit-to-Stand metrics showed no difference between groups.

	PKA	TKA	Mean Difference	p-value
Mean Time (s)	18.5 (5.6)	16.0 (5.6)	2.5	0.30
Minimum Knee Flexion (deg)	6.6 (5.8)	6.3 (6.6)	0.3	0.90
Peak Trunk Flexion (deg)	-44.0 (13.0)	-43.9 (14.8)	-0.1	0.99

Table 5. Computed differences in gait metrics between preferred and fast paced walking conditions reveals differences between PKA and TKA Patients, with significant (*p*<0.05 in bold).

	PKA (Mean Difference Between Walking Paces)	TKA (Mean Difference Between Walking Paces)[a]	Mean Difference Between Groups	p-value
Knee Flexion at initial contact (deg)	0.4 (1.4)	0.7 (1.2)	-0.3	0.61
Peak Stance Knee Flexion (deg)	**3.1 (0.6)**	**1.4 (1.6)**	**1.8**	**<0.001**
Knee Flexion Excursion (deg)	**2.8 (1.2)**	**0.7 (2.0)**	**2.1**	**0.002**
Peak Swing Knee Flexion (deg)	3.3 (3.9)	1.0 (3.0)	2.3	0.15
Stride Length (m)	**0.18 (0.07)**	**0.12(0.07)**	**0.1**	**0.038**
Overall Gait Speed (m/s)	0.31 (0.09)	0.25 (0.11)	0.06	0.13
Stride Width (m)	-0.001(0.01)	-0.002 (0.01)	0.001	0.80

[a]Data from 3 TKA participants were omitted because they did not perform the 30-second fast-paced walking task. Consequently, their 60-second preferred pace walking data were also excluded to ensure consistent calculation of differences.

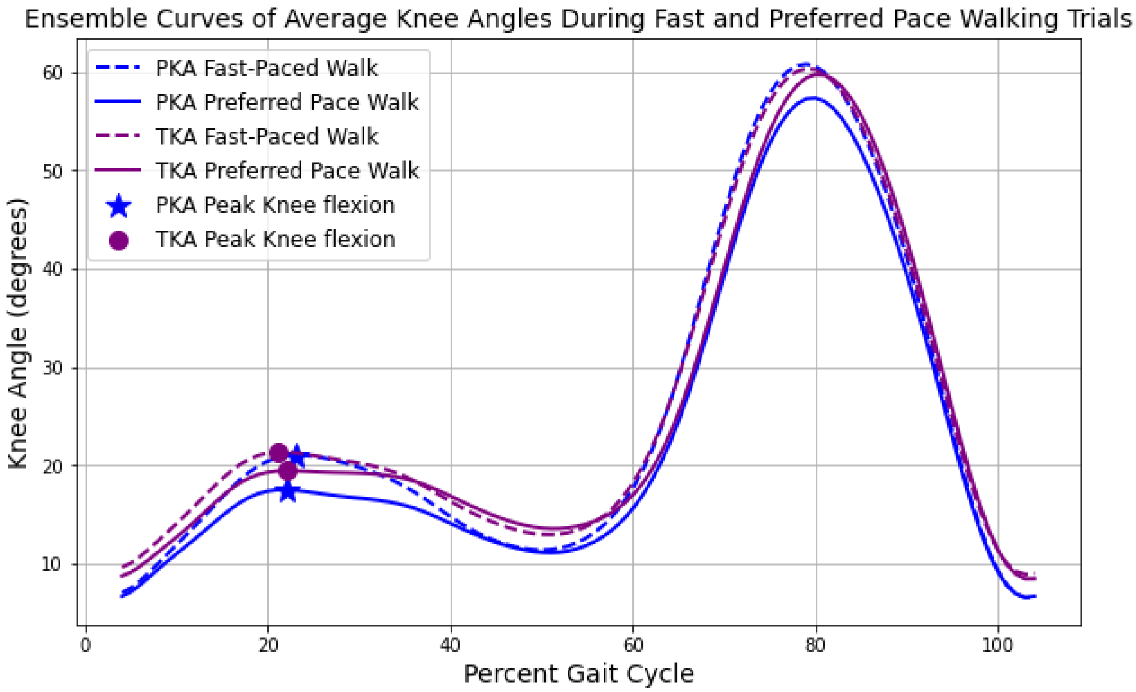

Figure 2. Ensemble knee flexion curves during preferred (solid) and fast pace (dashed) walking conditions for both PKA (blue) and TKA (magenta). Peak stance knee flexions are indicated for PKA (star) and TKA (circle).

7. Discussion

The purpose of this study was to uncover pre-operative differences in functional metrics of end-stage OA patients who underwent either a PKA or a TKA. Contrary to our hypothesis that patients undergoing a TKA would display reduced function in gait and sit-to-stand tasks, no differences were observed within any of the individual tasks or metrics themselves. However, this hypothesis was partially supported by the identification of significant differences in peak stance knee flexion, knee flexion excursions, and stride lengths between preferred and fast walking paces in PKA patients, but not in TKA patients. Overall, these findings suggests that OA patients who ultimately undergo a PKA exhibit a greater functional capacity pre-operatively, as they are able to adapt their gait in both a spatiotemporal manner (e.g., increased stride length) and knee flexion pattern (e.g., increased flexion during stance).

When examining gait and sit-to-stand movements independently, no significant differences were found between the PKA and TKA groups. It is important to recognize that the primary distinction between these groups lies in the involvement of multiple compartments, less than the severity of any single compartment. Additionally, although it is well-established that varying levels of radiographic severity can influence knee flexion during the gait cycle (Astephen Wilson et al., 2011), this is less clear with respect compartmental involvement (Mills et al., 2013). Despite the varying degrees of compartment involvement, all participants in this study were end-stage patients seeking joint replacements. Given this context, the absence of observable functional differences in these assessments may seem logical, as the commonality of end-stage disease likely supersedes the number of compartments affected.

Alternatively, when assessing the differences in walking between the two walking speeds, there were significant differences between the two groups. Specifically, PKA patients increased peak stance knee flexion, knee flexion excursion, and stride length at their faster pace, whereas the TKA maintained a similar gait pattern in both conditions. This suggests a limited functional capacity in TKA patients, wherein they are unable to adapt their gait to faster walking. These differences were not evident at a slower, preferred pace, but became apparent when patients were required to exert themselves more. Typically, healthier, more functional individuals can adjust their gait when increasing their pace by extending their stride and increasing knee flexion (Bari et al., 2023; Kumar et al., 2009; Liu et al., 2024). This constrained gait in TKA patients across speeds may be the result of increased knee stiffness due to the severe damage across multiple compartments. Conversely, PKA patients, experiencing less comprehensive involvement of compartments, may experience less stiffness and a greater ability to adapt their gait across different paces, as evidenced by the results of this study. While the assessment of gait at different speeds is not a novel concept and has been explored in patients with knee OA (Hoglund et al., 2019), it remains underrepresented in the literature. These findings suggest that differences observed between preferred and fast-paced gait may serve as important markers of capacity of function for knee OA patients.

While the study highlights key differences between PKA and TKA patients that warrant further examination both pre-operatively and post-operatively, it is important to discuss notably limitations. First, the significant age difference between PKA and TKA patients (57 years vs. 67 years; $p<0.01$) could influence the observed functional capacities (Gorial et al., 2018), and should be controlled or accounted for in future studies with larger sample sizes. The sample size of the current study, 8 PKA and 26 TKA patients, limits the ability to control for various factors such as age, and challenges the generalizability of the findings. Future research with larger samples is needed to more accurately establish and understand the pre-operative differences between PKA and TKA patients. Additionally, the selection of PKA and TKA candidates by a single surgeon, might introduce bias related to the surgeon's specific criteria and decision-making process, which may not reflect broader surgical practices. Lastly, this study measured pre-operative functional differences only at single time point. Future research could extend this investigation by monitoring these differences in walking paces at multiple points pre- and post-operatively. Such longitudinal data could provide valuable insights into whether these pre-operative differences in peak stance knee flexion, knee flexion excursion, and stride length persist over time.

8. Conclusion

In conclusion, this study underscores the importance of considering the differences in knee kinematics and spatiotemporal parameters, especially at varying paces, in patients undergoing knee replacement surgery. The significant differences observed in peak knee flexion, knee flexion excursions, and stride lengths between fast and preferred walking paces in PKA patients highlight their potential for greater adaptability and capacity for knee function and mobility compared to TKA patients. These findings support the inclusion of varied-pace walking tests in gait assessment protocols to gain deeper insights into pre-operative knee function. A more comprehensive understanding of these differences in functional capacity could inform surgical decisions and potentially encourage a broader application of PKAs.

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