

# Kinematic Analysis of Hip and Knee Arthroplasty Patients: an Inter- and Intra-Limb Comparison Before and After Rehabilitation

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## Summary

This study investigates kinematic differences between- and within-leg in total knee arthroplasty (TKA) and total hip arthroplasty (THA) patients using Statistical Parametric Mapping (SPM). Ancillary data from 13 TKA and 33 THA patients were analyzed. Hip and knee sagittal plane joint angle data were analyzed using SPM repeated measures ANOVA. Post-hoc t-tests following ANOVA revealed between-leg asymmetries (TKA: hip; THA: hip and knee) for both groups, all resolved after rehabilitation. Only THA patients showed increased joint patterns within the legs post-rehabilitation (operated side: hip and knee; non-operated side: knee). Rehabilitation resolved between-leg asymmetries in both groups. Overall, changes in timing and magnitude of joint angles from pre to post-rehabilitation were, however, low.

## Introduction

Total hip (THA) and total knee (TKA) arthroplasties continue to increase worldwide, yet differences in the kinematics of operated (OS) and non-operated sides (NS) following arthroplasty and related changes over time during initial rehabilitation are scarce in the literature. Additionally, kinematic assessments throughout movement cycles, in contrast to discrete time points, might be beneficial for an improved understanding of the rehabilitation process [1]. Therefore, the aim was to examine kinematic between-leg differences and within-leg changes from before (Pre) to after (Post) a 9-week rehabilitation, by use of statistical parametric mapping (SPM); both for patients following TKA and THA separately.

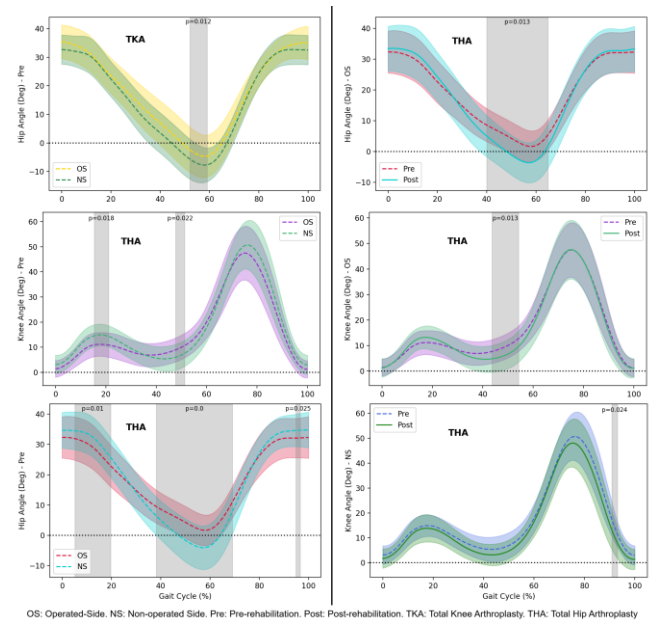
## Methods

Ancillary data from 13 TKA (56±4 years, 1.7±0.1 m, 92±13 kg) and 33 THA (54±7 years, 1.7±0.1 m, 87±14 kg) patients were pooled from a prior RCT [2]. Sagittal plane kinematics of hip and knee joints from 3D motion capture during overground gait were analyzed. Data was collected at 3 and 12 weeks post-surgery. Two separate two-way repeated measures ANOVA were conducted to compare inter-limb (OS vs NS) and within-limb (Pre vs Post) differences ( $p < .05$ ). Then, post-hoc SPM paired t-tests followed ( $p_{critical} < .025$ ).

## Results and Discussion

Post-hoc analyses following ANOVA revealed significant differences for TKA and THA at hip and knee angles (Figure

1). TKA patients showed between-limb differences only at the hip joint pre-rehabilitation. THA patients showed between-limb differences at the knee and hip joint pre-rehabilitation. Further, the THA group showed increased joint ranges in the knee (OS and NS) and hip sagittal angles (OS) from pre to post-rehabilitation, consistent with recent literature [3]. However, graphical comparisons with normative data (healthy individuals) showed that the timing and magnitude of joint angles after rehabilitation still deviated from typical gait patterns.



**Figure 1:** Statistically significant between-limb differences (left pane) and within-limb (right pane) changes.

## Conclusions

Rehabilitation resolved between-leg asymmetries in both groups. Overall, adaptations from pre to post-rehabilitation remain, however, small or non-existent, questioning the clinical significance of found alterations in angular joint motion due to rehabilitation. Follow-up investigations are required to monitor further adaptations over prolonged durations.

## References

- [1] Pincheira PA et al. (2019). *Clin. Biomech.*, **62**: 7-14.
- [2] Eichler S et al. (2019) *JMIR Rehab & Ass. Tech.*, **6**.
- [3] Bahl JS et al. (2018). *Ost. & Cart.* **26**: 847-863.