

Postoperative lower knee adduction moment limits patient-reported outcome improvements after medial opening wedge high tibial osteotomy

Guerrero Yareni¹, Hiranaka Takaaki¹, Parker David¹

¹Sydney Orthopedic Research Institute, Sydney Australia

Email: yguerrero@sori.com.au

Summary

Medial opening wedge high tibial osteotomy (MOWHTO) is a surgical intervention for medial knee osteoarthritis (OA) with varus malalignment, aiming to redistribute joint loading and improve function. This study analyzed 21 patients undergoing MOWHTO, assessing preoperative and postoperative (6 months) Knee Adduction Moment (KAM) using 3D gait analysis and PROMs (KOOS, WOMAC). Results showed significant reductions in KAM; however, higher postoperative KAM was associated with greater PROMs improvements. Patients with lower postoperative KAM had poorer PROMs improvements, suggesting that excessive valgus correction may be detrimental.

Introduction

Medial opening wedge high tibial osteotomy (MOWHTO) is a widely used surgical intervention for medial knee (OA) with varus malalignment. While MOWHTO effectively redistributes knee joint loading by correcting varus malalignment, direct biomechanical evidence linking the degree of medial compartment load reduction necessary to achieve improvements in PROMs remains limited [1, 2].

While KAM and radiographic varus alignment are critical factors associated with medial OA onset and progression [3] and, both factors are addressed by MOWHTO; varus alignment represents a static measure via radiographs, while KAM reflects dynamic 3D-motion evaluation, emphasizing their distinct characteristics. Although changes in alignment have been linked to clinical outcomes, the relationship between KAM and PROMs has not been thoroughly explored.

This study investigates the relationship between postoperative KAM and patient-reported outcome measures (PROMs) following MOWHTO.

Methods

Patients with symptomatic medial knee OA and varus malalignment (hip-knee-ankle angle $>3^\circ$) and undergoing MOWHTO resulted for this study. To evaluate KAM, cclinical gait analysis was conducted before and six months after surgery. 3D kinematic and kinetic 100Hz/1000Hz data

were captured, respectively utilizing Nexus System (VICON, Oxford Metrics Ltd., Oxford) with 10 optoelectrical cameras synchronized with a force plate (Advanced Mechanical Technology Inc., Watertown, MA) integrated to the laboratory floor. Knee Injury and Osteoarthritis Outcome Score (KOOS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), were assessed at baseline and 12m postoperatively. Pearson correlation analysis was performed to evaluate the association between peak KAM and PROMs (preoperative, postoperative, and Δ PROMs).

Results and Discussion

A total of 21 patients were included in this study, consisting of 19 males and 2 females, with a mean age of 50.8 ± 6.1 years, body mass index (BMI) 28.6 ± 4.2 kg/m².

Postoperative KAM 1st peak values significantly decreased, with a 53% ($p < 0.001$). While preoperative KAM negatively correlated with preoperative PROMs, no significant correlation was observed between postoperative KAM and postoperative PROMs. However, higher postoperative KAM was significantly associated with greater improvements in PROMs ($p < 0.05$).

Conclusions

Postoperative KAM is a key factor influencing functional recovery after MOWHTO. Patients with a postoperative KAM 1st peak below 26.0 Nm exhibited inferior PROMs improvements, suggesting that avoiding excessive valgus correction may optimize recovery. These findings support the integration of dynamic gait assessments with static radiographic evaluations to enhance postoperative management strategies and surgical planning.

References

- [1] Birmingham et al. (2017). *Osteoarthritis Cartilage*, 25: 1999-2006.
- [2] Iwasaki K. (2023) *J Sports Med*, 51:977-984
- [3] D'Souza, et, al. (2022). *Osteoarthritis Cartilage*, 30:381-396 374-386.

Table 1: Correlation analysis between postoperative KAM and Δ PROMs.

		KOOS Pain	KOOS Symptoms	KOOS ADL	KOOS Sport/Rec	KOOS QOL	WOMAC Pain	WOMAC Stiffness	WOMAC Function	WOMAC Total
KAM 1 st peak	Pearson correlation	0.555	0.313	0.496	0.397	0.048	0.587	0.511	0.497	0.551
	Significance	0.005*	0.084	0.011*	0.037*	0.418	0.003*	0.009*	0.011*	0.005*

KOOS Knee Injury and Osteoarthritis Outcome Score, ADL activities of daily living, Sport/Rec sport and recreation function, QOL knee-related quality of life. WOMAC, Western Ontario and McMaster Universities Arthritis Index. * $P < 0.0$

