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Gait Analysis Focusing On The Relationship Between Knee Biomechanics And Patient Outcome In Unilateral Total Knee Arthroplasty And Nonoperative Residual Osteoarthritis Knee

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Faculty Disclosure Information

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There are no disclosure with regard to this presentation.

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Introduction

Knee adduction moment (KAM) is often focused on total knee arthroplasty (TKA) research for assessing postoperative functional outcome [1, 2].

Several studies showed that KAM in TKA knees decreased postoperatively [3, 4], but others have not because of postoperative high gait speed as well as increased joint reaction force [5, 6]. Impact of operative knee on contralateral nonoperative osteoarthritis (OA) knee about gait analysis also remain unclear [3, 7].

Pain and coronal alignment in nonoperative knee OA might be improved after contralateral TKA [8]. In addition, lack of knee kinetic analysis in nonoperative knees might be due to difficulty of measuring tibiofemoral (TF) joint force directly.

Aim

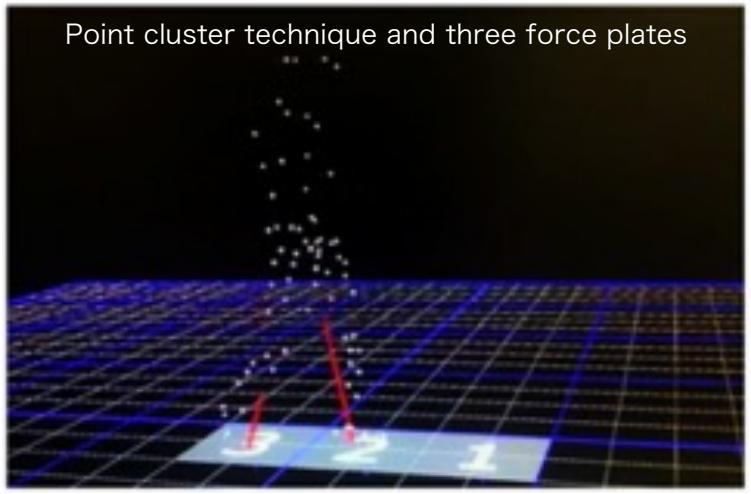
Aim of this study was to investigate pre- and postoperative changes of gait parameters based on an interactive musculoskeletal modelling software and knee joint pain in patients who underwent unilateral TKA for bilateral knee OA.

It was hypothesized that postoperative knee joint pain in nonoperative knees would decrease for improved gait parameters after contralateral TKA because TF joint forces in nonoperative knees were reduced.

Methods

In this prospective study, 10 patients (mean age, 74 years) with bi-lateral varus knee OA were participated, which included Kellgren–Lawrence grade 2 or greater severity by knee radiographs and underwent posterior cruciate-substituting TKA with follow-up for more than 2 years.

Gait measurements in bilateral knees preoperatively and 1-year follow-up after TKA were analyzed using point cluster technique [9] and three force plates.



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Methods

Interactive musculoskeletal modelling software was used for calculating KAM, knee flexion moment, TF joint force, and quadriceps femoris (QF) muscle force during each gait phase.

Knee extension and flexion angles, hip-knee-angle angle as radiographic parameter, and 2011 Knee Society Knee Scoring System (2011 KSS) [10] were also measured pre- and postoperatively.

Association between amount of pre- and postoperative change (Δ) in 2011 KSS and each Δ clinical evaluations or Δ gait analysis parameter was investigated (Δ, postoperative value minus preoperative value).

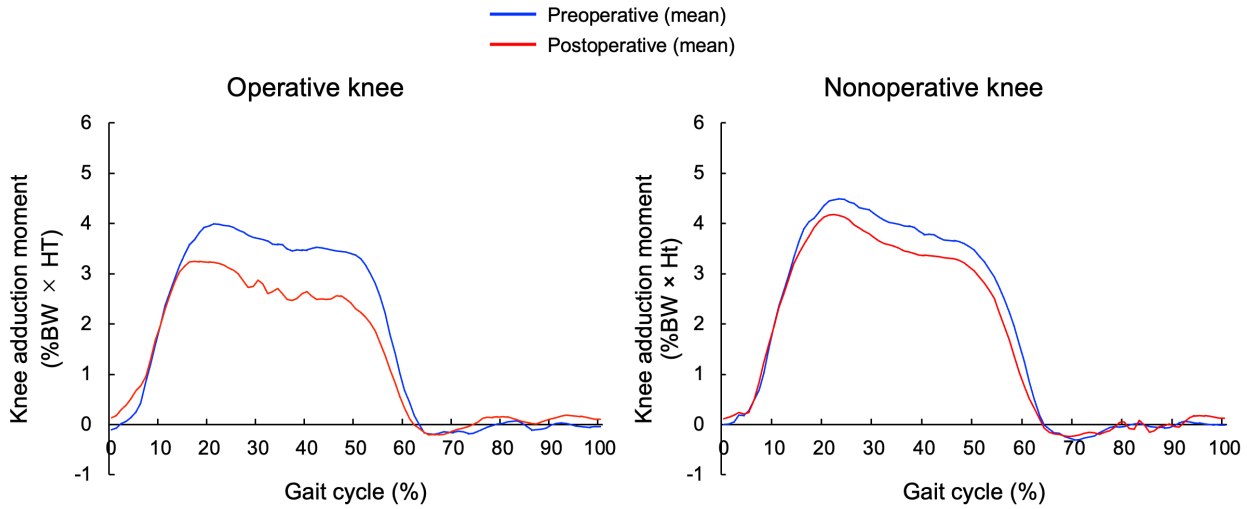
Results

For operative knee, peak KAM was lower, and TF joint force was higher postoperatively than preoperatively, but all parameters including nonoperative knees did not have significantly different before and after TKA.

Variables	Operative knees			Nonoperative knees		
	Preoperative	Postoperative	P	Preoperative	Postoperative	P
Peak gait flexion angle, ° (SD)	67 (9)	71 (5)	NS	70 (7)	70 (6)	NS
Peak KAM, % body weight × body height (SD)	5 (1)	4 (1)	NS	5 (1)	5 (1)	NS
Peak flexion moment, % body weight × body height (SD)	4 (2)	4 (2)	NS	4 (1)	5 (2)	NS
Peak TF joint force, N (SD)	591 (99)	624 (91)	NS	606 (91)	617 (84)	NS
Peak QF muscle force, N (SD)	305 (126)	295 (119)	NS	281 (120)	312 (119)	NS
Peak gait speed, m/s (SD)	1 (0.3)	1 (0.3)	NS			

Results

However, gait analyses showed that postoperative KAM was significantly lower than preoperative KAM at 30%, 40%, and 50% phases for operative knee, and only at 60% phase for nonoperative knee, all in stance phase.



Results

Postoperative gait flexion moment was higher than preoperative moment at 100 % swing phase only in nonoperative knee.

Meanwhile, in operative knee, postoperative TF joint force was significantly larger than preoperative force at 10% stance phase and 70% swing phase, while preoperative QF muscle force was larger than preoperative force at 100% swing phase.

Operative knees with postoperative decreased KAM had high 2011 KSS total and functional score improvement, while increased knee flexion moment in gait analysis was correlated with only total score .

On the other hand, in nonoperative knees, only factor that correlated with decreased symptom score was increased postoperative gait speed.

Discussion

Gait analysis particularly showed that postoperative KAM significantly decreased in mid to late stance phase, and postoperative TF joint force increased in heel strike and early swing phases.

This suggests that preoperative avoidance gait from knee pain was improved by post-TKA pain relief.

Contralateral TKA did not improve postoperative symptom score in the nonoperative knees. This is because postoperative decreased symptoms score was significantly correlated with only increased gait speed due to contralateral TKA.

Conclusion

Patients with advanced nonoperative knee OA increased gait speed after successful contralateral TKA and might easily feel more knee pain postoperatively than preoperatively.

We believe that patients with increased gait speed after contralateral TKA might reasonably be considered for TKA in nonoperative knees.

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