



GAIT ANALYSIS IN PATIENTS AFTER TOTAL KNEE ARTHROPLASTY: A SYSTEMATIC REVIEW AND META – ANALYSIS

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ABSTRACT

Introduction: Total Knee Arthroplasty (TKA) is an effective treatment option for patients in end-stage osteoarthritis. Its effectiveness in reducing pain and increasing patient's functionality has been scientifically proven. However, there are gait abnormalities even after TKA compared to a healthy population.

Purpose: The purpose of this study is the comparative assessment of qualitative characteristics of gait (kinetic, kinematics and spatio-temporal gait characteristics) between patients that have undergone TKA and healthy population.

Study selection and population characteristics: The systematic search of the electronic databases (PubMed, Cinahl Plus, Cochrane, Clinical trials, Scopus) identified a total of 2071 studies, 40 of which were selected for full text screening. 14 studies were considered eligible for data extraction and meta-analysis according to our eligibility criteria.

Results: Regarding patients that undertook fixed bearing TKA, the studies reported statistically significant (p<0,05) reduced walking speed, stride length, max knee flexion, knee angle ROM and cadence both before and after the intervention compared to healthy controls.

Regarding patients that undertook mobile bearing TKA and healthy controls, the studies reported statistically significant (p<0,05) reduced walking speed, cadence and knee angle ROM and increased stride time before and after the intervention compared to healthy controls. Specifically for maximum knee flexion, before the intervention, there was statistically significant (p<0,05) reduced maximum knee flexion of mobile bearing TKA patients compared to healthy controls. But postintervention (up to 12m after the intervention), no statistically significant difference (p>0,05) on max knee flexion was observed between the same groups.

Conclusion: Both for fixed and mobile bearing TKA patients, statistically significant deficits in qualitative characteristics of gait remain postoperatively compared to a healthy population with the exception of maximum knee flexion of mobile bearing TKA patients that reached normal values.

Key words: TKA, Gait, mobile bearing, fixed bearing, osteoarthritis

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INTRODUCTION

BACKGROUND

- Knee osteoarthritis is one of the most common chronic diseases
- Patients with knee OA often present with altered gait and movement patterns
- Total arthroplasty is the most common treatment for advanced knee osteoarthritis

TKA & GAIT

- two-thirds of patients showed significant improvement after knee arthroplasty surgery, but a large percentage reported complication
- 30% of patients declare themselves unsatisfied after knee arthroplasty
- Patients reported a feeling of pain retention, fear, stiffness and as a result their quality of life is affected
- limitations in certain activities such as walking, climbing stairs and difficulty in returning to sports activities

METHODS AND MATERIALS

The search strategy for this systematic review involved comprehensive searches in multiple electronic databases, including PubMed, Cinahl Plus, Cochrane library, Clinical trials and Scopus. The databases were selected to ensure coverage of relevant literature across medical, nursing, allied health, and clinical trial domains. The search terms and keywords used in the strategy were carefully chosen to capture studies related to TKA and gait analysis. The key terms employed in the search included "Total Knee Arthroplasty", "Total Knee Replacement", "TKA", "TKR", "Gait Analysis", "Gait", "Gait Parameters". These terms were combined using Boolean operators (AND, OR) and were adapted to the specific syntax requirements of each database. Qualitative characteristics of gait (kinetic, kinematics and spatio-temporal gait characteristics) were assessed.

RESULTS

Fixed TKA vs. controls

Significantly reduced walking speed, stride length, max knee flexion, knee angle ROM, and cadence was observed both before and after the intervention for the fixed TKA group in comparison to the controls.

Mobile TKA vs. controls

Statistically significant reduced walking speed, cadence and knee angle ROM was reported before and after the intervention for the mobile TKA group in comparison to the controls. In addition, significantly increased stride time before and after the intervention and reduced max knee flexion before the intervention was observed for the mobile TKA group in comparison to the controls. On the other hand, there is no statistically significant differences for max knee adduction before and after the intervention and for max knee flexion after the intervention for those who undertook MTKA compared to healthy controls.

OUTCOMES	FIXED TKA vs HEALTHY CONTROLS		FIXED TKA vs HEALTHY CONTROLS	
	BI	AI	BI	AI
	S	NS	S	NS
WALKING SPEED	REDUCED		REDUCED	
CADENCE	REDUCED		REDUCED	
STRIDE LENGTH	REDUCED		REDUCED	
STEP LENGTH	REDUCED		NO RESULTS	
MAX KNEE FLEXION	REDUCED		REDUCED	
KNEE ANGLE ROM	REDUCED		REDUCED	

Table 1. Fixed TKA vs healthy controls

OUTCOMES	FIXED TKA vs MOBILE TKA	FIXED TKA vs MOBILE
	BI	AI
	S	NS
WALKING SPEED		☑
CADENCE		☑
STRIDE TIME		INCREASED
MAX KNEE ADDUCTION	INCREASED	INCREASED
KNEE ANGLE ROM		☑

Table 3. FTKA vs MTKA.

OUTCOMES	FIXED TKA BI vs FIXED TKA AI	
	S	NS
WALKING SPEED	INCREASED	
STRIDE LENGTH	INCREASED	
STANCE TIME	DECREASED	
STEP LENGTH	INCREASED	
FLEXION ROM (loading response)	INCREASED	
KNEE ANGLE ROM	INCREASED	

Table 4. FTKA BI vs FTKA AI.

RESULTS

Fixed TKA vs. Mobile TKA

Statistically significant increased max knee adduction was reported before and after the intervention for those who undertook fixed TKA. It was also showed a statistically significant increased stride time after the fixed TKA. No statistically significant differences have been reported for the rest outcomes.

FIXED TKA BI vs FIXED TKA AI

Statistically significant increased walking speed, step length, stride length, flexion ROM, knee angle ROM and decreased stance time was observed for the timepoint before the intervention

MOBILE TKA BI vs MOBILE TKA AI

Statistically significant differences was reported for increased walking speed before the intervention, while there are no statistically significant differences reported for the rest of the outcomes.

OUTCOMES	MOBILE TKA vs HEALTHY CONTROLS		MOBILE TKA vs HEALTHY CONTROLS	
	BI	AI	BI	AI
	S	NS	S	NS
WALKING SPEED	REDUCED		REDUCED	
CADENCE	REDUCED		REDUCED	
STRIDE TIME	INCREASED		INCREASED	
MAX KNEE ADDUCTION		☑		☑
MAX KNEE FLEXION	REDUCED			☑
KNEE ANGLE ROM	REDUCED		REDUCED	

Table 2. Mobile TKA vs healthy controls.

OUTCOMES	MOBILE TKA BI vs MOBILE TKA AI	
	S	NS
WALKING SPEED	INCREASED	
STRIDE TIME		☑
CADENCE		☑
MAX KNEE FLEXION		☑
MAX KNEE ADDUCTION		☑
KNEE ANGLE ROM		☑

Table 5. MTKA BI vs MTKA AI.

DISCUSSION

Knee osteoarthritis is a chronic skeletal disease with high incidence in the total population. The most usual signs are altered gait and movement patterns. Total arthroplasty is the preferable treatment for advanced knee osteoarthritis. Nevertheless, it seems that gait and movement problems may insist even after the surgical treatment. In the present study we focused our retrospective interest on publications who present comparative results between operated patients and healthy people, while comparison were applied before and after surgical intervention. In brief, after statistical elaboration of obtained data, we concluded that gait and mobility patterns are still affected after f-TKA and M-TKA.

CONCLUSIONS

Although TKA (mobile or fixed) is the treatment of choice for knee osteoarthritis, it seems that restoration of mobility status is not completed after TKA. Further research is necessary to elucidate critical aspects of the surgical treatment as well as the necessity and the orientation of rehabilitation programs, which may assist the total therapeutic approach

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