

## Review

# Longitudinal changes in knee kinematics and moments following knee arthroplasty: A systematic review



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## ABSTRACT

**Background:** Knee arthroplasty (KA) is recognized as an effective treatment of knee joint osteoarthritis and up to 90% of patients experience substantial pain relief. There has been no systematic review synthesizing the longitudinal changes in gait following KA. The aims of this systematic review were to determine the effects of KA on (i) frontal plane and (ii) sagittal plane kinematic and kinetic parameters during the stance phase of gait.

**Methods:** MEDLINE (PubMed), CINAHL, SPORTdiscus (EBSCO), and Cochrane Library (Wiley) were searched until April 10th, 2014. 1,765 articles were identified, of which 19 studies describing 3-dimensional gait analysis pre- and post-KA were included. Study quality was evaluated by two reviewers independently using the Downs and Black checklist.

**Findings:** Following KA, in the frontal plane, the maximum knee adduction angle and external knee adduction moment (KAM) tended to decrease. In the sagittal plane, findings suggest that the maximum knee flexion moment is increased. From the ten studies that included a healthy reference group, it was unclear whether gait variables returned to normal following KA.

**Interpretation:** Overall, it appears that KA results in a decreased peak KAM and maximum knee adduction angles, an increased peak knee flexion moment and inconsistent changes in the peak knee flexion angle. Knowledge gaps remain due to methodological inconsistencies across studies, limited statistical analysis, and largely heterogeneous sample populations. More research is needed to determine whether KA restores gait patterns to normal, or if additional rehabilitation may be needed to optimize gait following surgery for osteoarthritis.

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## Contents

1.	Introduction . . . . .	995
2.	Search strategy and criteria . . . . .	999
2.1.	Eligibility . . . . .	999
2.2.	Data extraction . . . . .	999
2.3.	Quality evaluation . . . . .	1005
2.4.	Data analysis . . . . .	1005
3.	Results . . . . .	1005
3.1.	Study characteristics . . . . .	1005
3.2.	Frontal plane . . . . .	1005
3.3.	Sagittal plane . . . . .	1005
3.4.	Comparison to control group, where available . . . . .	1005
3.5.	Quality evaluation . . . . .	1006

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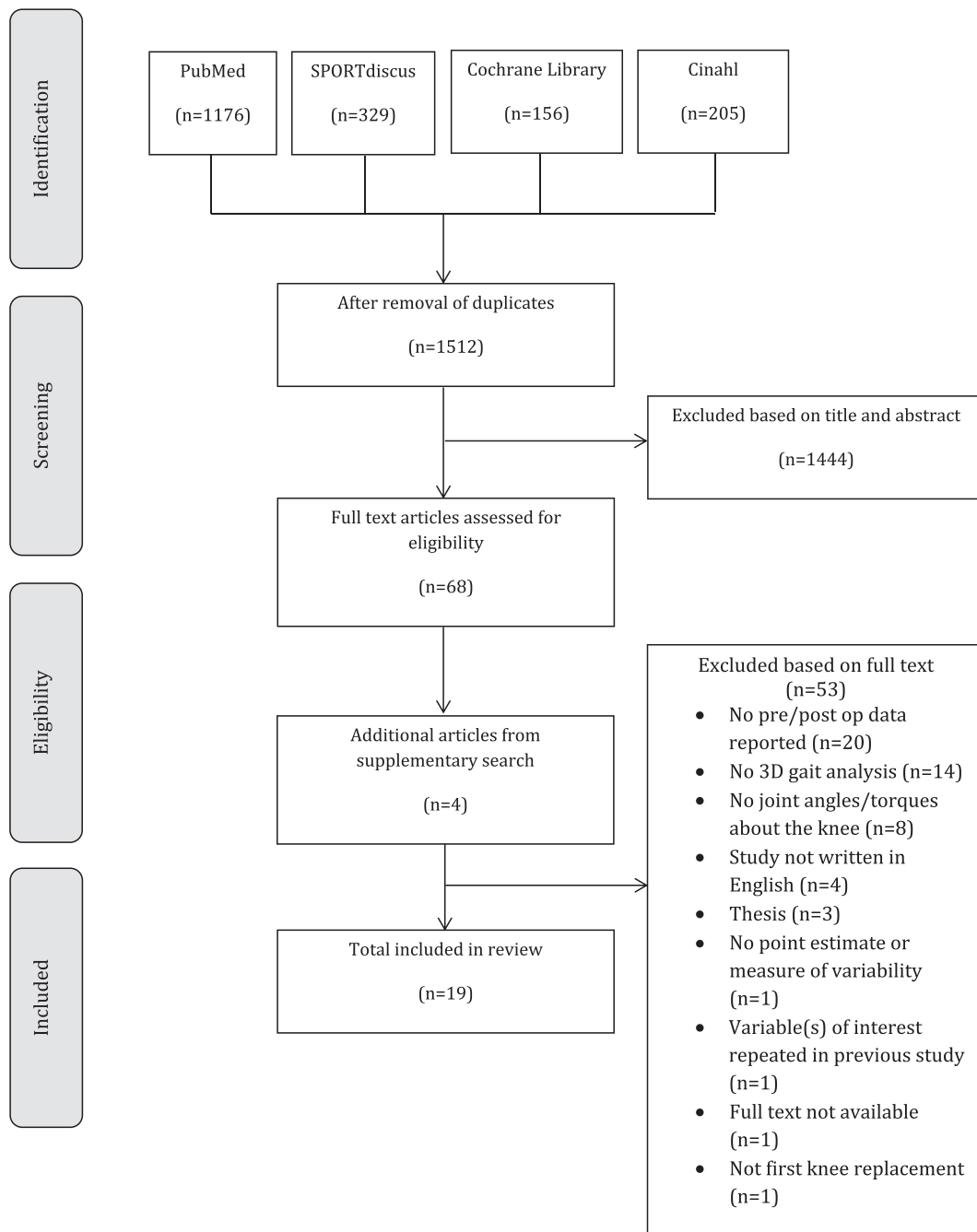
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4. Discussion	1006
Financial support	1007
Conflict of Interest	1007
References	1007

**1. Introduction**

First popularized in the 1970s [1], knee arthroplasty (KA) is recognized as an effective treatment of advanced knee joint osteoarthritis (OA). Gait abnormalities and increased joint loading are associated with knee OA [2–4], and often increase as disease severity and knee pain worsen over time. In particular, frontal plane abnormalities in

kinematics (joint motion) and kinetics (joint moments) are of importance in knee OA as they have been linked to disease progression [5–7]. These abnormalities include: higher external knee adduction moment (KAM) [8–10] and KAM impulse [11], as well as an increased incidence of abnormal varus-valgus motion [6] when compared to those without OA. Persistent abnormal gait biomechanics following KA may contribute to sub-optimal clinical outcomes from the procedure



**Fig. 1.** A flow chart of the study selection process.

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