No Difference in Five-Year Clinical and Radiographic Outcomes Between Kinematic and Mechanical Alignment in TKA – A Randomized Controlled Clinical Trial

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Simon W Young*†, Niall P T Sullivan*, Sherina Holland*, Ali Bayan*, Matthew L Walker*, Bill Farrington*

*Department of Orthopaedic Surgery, North Shore Hospital, 124 Shakespeare Road, Takapuna, Private Bag 93-503, Auckland 0740, New Zealand

† Department of Surgery, University of Auckland, Auckland, New Zealand

Introduction

Kinematic Alignment (KA) technique in total knee arthroplasty (TKA) attempts to match implant position to the pre-arthritic anatomy of an individual patient, with the goal of improving functional outcomes. This contrasts with a traditional neutral mechanical alignment (MA) goal. The effect of these changes on implant survivorship remains unknown.

This study compares the mid-term survivorship and functional outcomes between these two techniques, including radiographic assessment for signs of implant loosening/failure.

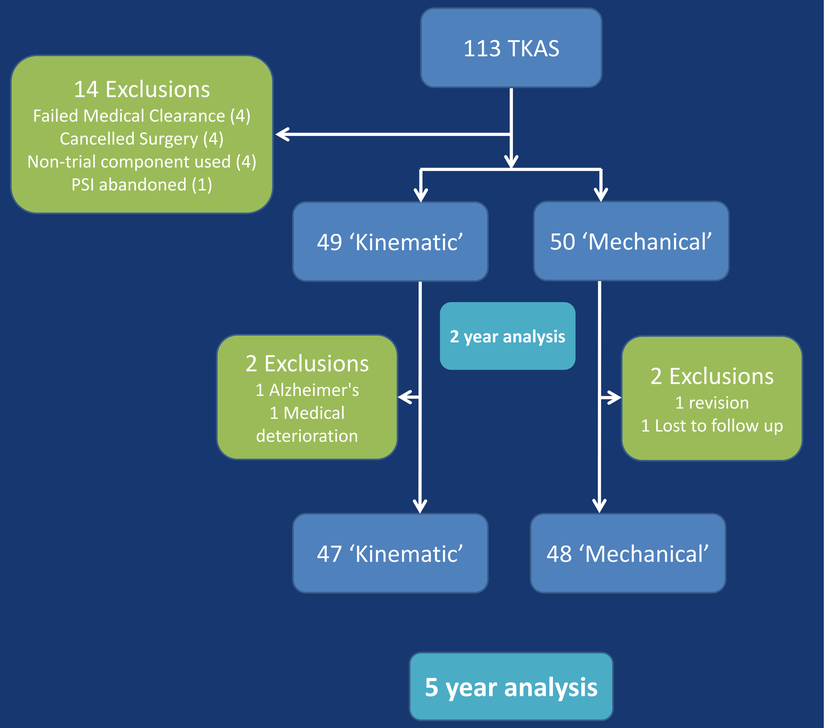

Figure 1 Consort Diagram for ShapeMatch Study

Methods

Ninety-nine patients undergoing primary TKA for osteoarthritis were randomized to either MA (n=50) or KA (n=49) groups. (Figure 1).

Patients underwent pre-operative alignment assessment using full-length MRI scans. Computer Navigation was used for patients in the MA group. Patient specific cutting blocks were manufactured for patients in the KA group.

Alignment was assessed with post-operative CT scans, and radiographs obtained post operatively and at 1, 2, and 5 years (Figure 2 A-D). Functional outcome scores were assessed pre-operatively and at 6 weeks, 6 months, 1, 2 and 5 years post-operatively. Standard short-leg radiographs were assessed using the Modern Knee Society Radiographic Evaluation System.

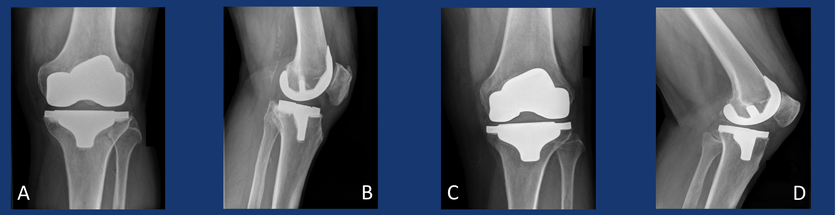

Figure 2 Radiographs of Mechanical versus Kinematic Alignment TKA
Five years post op. A - B) Mechanical Alignment, C - D) Kinematic Alignment

Table 1 Prevalence of radiolucent lines

Radiolucent lines	KA	MA
>1 Zone	15	20
Static	12	14
Progressive	3	6

Static: Demonstrates static radiolucent lines only

Progressive: Demonstrates progressive or a combination of static + progressive radiolucent lines

Table 2 Total number of reoperations

Reason	KA	MA
Fracture	-	1
Patella instability	1	1
Arthrofibrosis/MUA	2	-
PJI	1	1
Other minor	1	1
Polyethylene wear	1	-

Table 3 Revision Tibial/Femoral Component

Reason	KA	MA
PJI		1

Results

There were no significant differences in the presence of static or progressive radiolucent lines between MA and KA groups (Table 1).

There were no differences in the number of re-operations between MA and KA groups (Table 2 & 3).

There was no significant difference in patient reported outcome measures (PROMs) at five years (Figure 3).

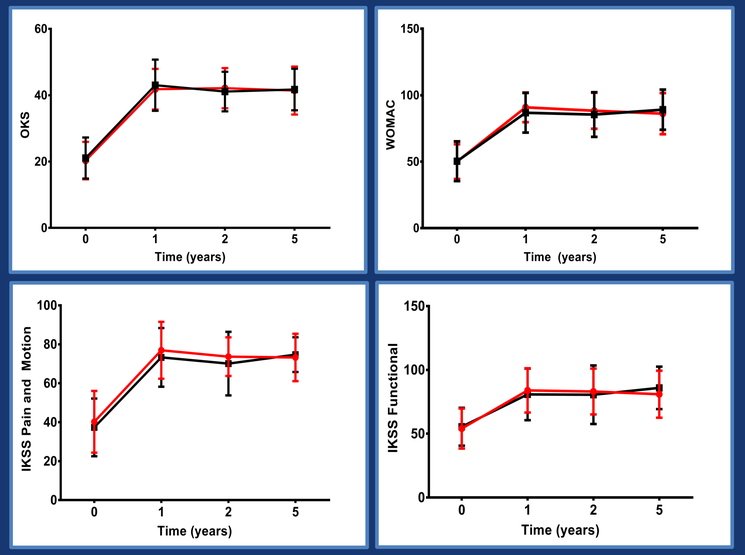

Figure 3 MA vs KA PROMS at pre-op and at 1, 2 and five years post op
Groups: Black = MA, Red = KA. OXS: Oxford Knee Society Score, **WOMAC:** Western Ontario and McMaster Universities Score, **IKSS:** International Knee Society Score

Conclusion

No difference was found in functional or radiographic outcomes between TKAs implanted with MA or KA. Revision and re-operation rates were similar and at five years there were no significant differences in radiographic signs of loosening. These mid-term results support the two-year findings of no difference in MA vs KA, however the impact on long term survivorship is still unknown.