Correction to: Similar results with kinematic and mechanical alignment applied in total knee arthroplasty

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Dear Editors,

Our article entitled “Similar results with kinematic and mechanical alignment applied in total knee arthroplasty” was submitted to KSSTA in Feb 2019. It was a meta-analysis including nine trials that compared functional, radiological, perioperative results and complications in total

knee arthroplasty (TKA) with kinematic alignment (KA) and mechanical alignment (MA). The conclusion that “KA achieved functional, radiological, and perioperative results similar to those of MA and did not increase the complication rate” was reached through strict and careful statistical analysis. However, we did not notice that one of the included studies, Yeo et al. [7], was corrected in June 2019 [5, 6], after our article was published, and did not actually compare KA to MA. After removing this study, some outcomes changed. There are also some new recently published articles that meet our inclusion criteria [3, 4]. It is necessary to include these latest studies, correct the forest plots and modify the results.

Two new trials published from March 2019 to October 2019 were included, and detailed characteristics of the studies are displayed in Table 1.

The functional results in the original article should be corrected. The WOMAC scores were converted (98 minus WOMAC score, best score of 98 and worst score of 0), and if the lines of any outcome measures in the forest plot were on the right side of the centerline, this would indicate favor for KA. KA showed a significant difference in the WOMAC score ($Z=3.60$, $P<0.001$), KSS function ($Z=3.19$, $P=0.001$), OKS ($Z=2.02$, $P=0.04$), and overall effect ($Z=4.78$, $P<0.001$), as shown in Table 2 and Fig. 1. However, no significant differences were discovered in other clinical measurements. The outcome measures indicated that the functional outcomes of KA were similar to or better than those of MA.

The findings for the radiological results and complications were consistent with those in the original article. KA showed similar results in terms of the joint line orientation angle (JLOA), hip–knee–ankle angle (HKA), femorotibial angle (FTA), femoral flexion–extension angle (FFA), and tibial slope (TS). KA resulted in a significantly smaller mechanical lateral distal femoral angle (mLDPA) and mechanical medial proximal tibial angle (mMPTA), as shown in Table 2 and Fig. 2. No significant differences were

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Table 1 Characteristic of the studies

Studies	Location	Study design	Minimum follow-up (m)	Sample size		Mean age		Female		Prosthesis design	Operative method	Clinical measurements	Radiological measurements	Other measurements	Quality score
				KA	MA	KA	MA	KA	MA						
Niki et al. [4]	Japan	RCS	100	100	100	73.4	74.2	75	85	KA: Zimmer-Biomet, CR or PS, FB, MR, cemented MA: Zimmer-Biomet, CR or PS, FB, MR, cemented	KA: ATHENA software MA: Computer navigation	ROM	FTA	2011 KSS	6
McEwen et al. [3]	Australia	PRCT	36	41	41	65	65	N/A	N/A	KA: Triathlon, CR, FB, SR, cement-less femur, cemented tibia, PR MA: Triathlon, CR, FB, SR, cement-less femur, cemented tibia, PR	KA: PSI MA: Computer navigation	KOOS, OKS, FJS, ROM	HKA, JLOA, CFI, CTI, FFA, TS	Complications, Gap Laxity, Ligament Releases	7

N/A not applicable, *PRCS* prospective randomized controlled trial, *RCS* retrospective cohort study, *CR* cruciate-retaining, *PS* posterior-stabilized, *FB* fixed-bearing, *MB* mobile-bearing, *SR* single-radius, *MR* multi-radius, *PR* patella resurfacing, *PSI* patient-specific instrument, *OKS* Oxford knee score, *KSS* Knee society score, *ROM* range of motion, *KOOS* Knee injury and osteoarthritis outcome score, *VAS* visual analogue scale, *HKA* hip-knee-ankle angle, *CFI* coronal femoral inclination, *CTI* coronal tibial inclination, *FFA* femoral component flexion/extension angle, *TS* tibial slope

Table 2 Primary and secondary outcomes of the meta-analysis

Parameters	Studies (<i>n</i>)	Knees (<i>n</i>)	Overall effects		Heterogeneity <i>P</i> value (<i>I</i> ²)	Model
			<i>P</i> value	MD/OR (95% CI)		
Clinical results						
WOMAC	4	469	0.0003	10.59 (4.82, 16.36)	0.02 (71%)	Random
KSS (knee)	5	382	n.s.	4.00 (− 2.23, 10.24)	0.002 (76%)	Random
KSS (function)	4	311	0.001	8.54 (4.16, 12.93)	0.24 (29%)	Fixed
OKS	4	351	0.04	3.34 (0.10, 6.57)	0.002 (80%)	Random
KOOS	3	189	n.s.	2.95 (− 1.53, 7.43)	0.18 (42%)	Fixed
FJS	2	181	n.s.	1.52 (− 5.37, 8.42)	0.70 (0%)	Fixed
EQ-5D	2	170	n.s.	− 1.41 (− 6.25, 3.42)	0.44 (0%)	Fixed
ROM (flexion)	6	565	n.s.	2.59 (− 0.35, 5.53)	0.06 (53%)	Random
ROM (extension)	3	252	n.s.	− 0.23 (− 0.88, 0.42)	0.57 (0%)	Fixed
Radiological results						
HKA	5	387	n.s.	0.00 (− 0.50, 0.51)	0.46 (0%)	Fixed
FTA	5	511	n.s.	− 0.57 (− 2.35, 1.21)	<0.001 (91%)	Random
mLDPA	6	587	<0.001	− 1.96 (− 2.35, − 1.56)	0.65 (0%)	Fixed
mMPTA	6	505	<0.001	− 2.23 (− 2.58, − 1.89)	0.98 (0%)	Fixed
JLOA	5	418	n.s.	0.09 (− 2.56, 2.73)	<0.001 (97%)	Random
FFA	4	400	n.s.	1.08 (− 0.56, 2.73)	<0.001 (84%)	Random
TS	5	499	n.s.	0.72 (− 0.63, 2.08)	<0.001 (78%)	Random
Complications						
Total major	5	551	n.s.	0.89 (0.33, 2.40)	0.79 (0%)	Fixed
Total minor	4	351	n.s.	1.17 (0.40, 3.41)	0.87 (0%)	Fixed

WOMAC Western Ontario and McMaster Universities Osteoarthritis Index, OKS Oxford knee score, KSS Knee society score, ROM range of motion, KOOS Knee injury and osteoarthritis outcome score, EQ-5D EuroQoL 5-dimension questionnaire, HKA hip-knee-ankle angle, FTA femoral tibial angle, mLDPA mechanical lateral distal femoral angle, mMPTA mechanical medial proximal tibial angle, FFA femoral component flexion/extension angle, TS tibial slope. *P* < 0.05 indicates a significant difference

Fig. 1 Flow chart of the selection procedure

Fig. 2 Radiological angles. 1 Hip–knee–ankle angle (HKA). 2 Femoral knee angle (FKA). 3 Anatomical knee angle (AKA). 4 Mechanical lateral distal femoral angle (mLDFA). 5 Femoral mechanical angle (FMA). 6 Coronal femoral inclination (CFI). 7 Mechanical medial

proximal tibial angle (mMPTA). 8 Tibial mechanical angle (TMA). 9 Coronal tibial inclination (CTI). 10 Joint line orientation angle (JLOA). 11 Femoral flexion–extension angle (FFA). 12 Tibial slope (TS)

Fig. 3 Risk of bias graph; “plus” indicates a low risk of bias; “minus” indicates a high risk of bias; and “question mark” indicates unclear or unknown risk of bias

discovered between KA and MA in terms of complications, as shown in Table 2 and Fig. 3.

Thus, the conclusion should be modified, as follows: KA yielded similar or better functional results and similar radiological and perioperative results as MA and did not increase the complication rate. KA is an acceptable and satisfactory method for application in TKA.

Our results are in accordance with previous researches [1, 2]. The number of studies included in this meta-analysis is relatively small, so a change in any of the articles may lead to bias and error. Further research should include additional relevant articles to improve the study. This also reminds us that we should search the literature more carefully in future research.

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