What is the optimal fixation method for stems used during revision TKA?

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Response/Recommendation:

The current literature indicates no significant superiority of using a specific stem fixation method for revision total knee arthroplasty (rTKA) regarding various postoperative outcomes. Therefore, we recommend that cemented and cementless fixation methods could be utilized based on individual situations and surgeon preference.

Level of Evidence: Moderate

Rationale:

Despite the widespread use of tibial and femoral stems for enhancing join stability in rTKA, the proper indications and optimized fixation methods remain controversial [1]. The scope of this systematic review was limited to the comparative publications (cemented vs. cementless), and single-group studies were excluded. 13 articles were eligible for inclusion, and most of them had a retrospective design. Only 4 studies had a prospective design [2-5], 3 of which were one randomized clinical trial in different follow-ups [2-4]. The general details of the included articles are mentioned in **Table 1**.

None of the included studies reported significant ($P<0.05$) superiority of each fixation method in regards to aseptic loosening rate, overall revision rate, failure rate, PJI rate. In regards to PROMs, only the study by Jacquet et al. reported superiority of cemented fixation as measured by KSS Function score [6]. Although, it is important to point out that the cemented stems used in their

series were short stems, while longer uncemented were utilized. Other studies did not find a significant ($P<0.05$) superiority of each fixation method in regards to KSS clinical, KSS Function, WOMAC, ROM, and VAS pain.

There has been one RCT published that compared the stem fixation in a limited number of patients undergoing rTKA [2-4]. Unfortunately, due to the small sample size one is not able to make concrete conclusion regarding the superiority of each fixation technique. The investigatoys of the latter study followed their patients for ten years [4]. In the latest follow-up, they did not find any difference between the two fixation methods with regards to micromotion, complications, and PROMs [4].

A meta-analysis was performed regarding the extracted clinical and radiological outcomes. The analysis revealed no statistically significant differences between cemented and cementless stem fixation groups in the overall failure rate ($p = 0.264$), the overall revision rate ($p = 0.213$), revision due to aseptic loosening ($p = 0.191$), revision due to periprosthetic joint infection (PJI) ($p = 0.649$), radiolucent lines ($p = 0.659$), KSS-clinical score ($p = 0.102$), KSS-functional score ($p = 0.431$), WOMAC Osteoarthritis Index ($p = 0.067$) and Visual Analogue Scale (VAS) ($p = 0.672$).

There were some limitations in the existing literature. Number of studies and sample size were limited. Most of studies were retrospective cohorts with limited follow-ups and significant confounding factors. Most of the studies reported tibial stem and femoral stem together. Different bone qualities were noted in the existing literature. Different prosthesis in regards to constrain level were used. Studies used different stem lengths and diameters in each technique. Some studies did not report stem lengths used, and others used a variety of stem lengths. Therefore, we could not evaluate the effect of stem length on the reported outcomes. Most studies reported shorter

stems for cemented fixation; this could have an effect on the outcomes. Despite these notable confounding factors, no significant superiority of each technique was reported in the literature.

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Figures:

Table.1 Details of the included studies

Study	Year	No of Patients (C)	No of Patients (CL)	Mean Follow-up (Months)	Mean Age (Years)	Female %	Tibial Stem or Femoral Stem	Constrain level	Bone Quality	stem length	Specific rTKA
Cintra[7]	2011	21	9	53	62.8	53.8	T	all were unconstrained	I in 5, II in 7, III in 8	NR	No
Edwards[8]	2014	51	63	45	65	49.1	T+F	120 constrained, 108 unconstrained	100 stems had poor bone quality	NR	Two-stage infected rTKA

Gililland[9]	2014	49	32	96	64.6	56.8	T+F	71% unconstrained in C, 27% VV constrained in C, 2% hinge in C, 6% unconstrained in CL, 94% VV constrained in CL	17% poor bone quality in C, 3% poor bone quality in CL	NR	No
Heesterbeek[2]	2016	16	16	24	65.75	71.9	T+F	2 constrained in C, 4 constrained in CL	only in AORI I/II	15 cm femur of C in 11, 16 cm femur of C in 5, 15 cm femur of CL in 9, 16 cm femur of CL in 7, 12 cm tibia of C in 15, 13 cm tibia of C in 1, 12 cm tibia of CL in 12, 13 cm tibial of CL in 4	RCT
Fleischman[10]	2017	54	158	61.6	64.4	60.4	T+F	83% constrained in C, 91% constrained in CL	44% II/III in C, 30% II/III in CL	8.6 cm in C, 9.4 cm in CL	No
Kosse[3]	2017	12	11	78	70.13	65.2	T+F	NR	only in AORI I/II	same length	mid-term follow up of the RCT
Gomez-Vallejo[11]	2018	29	38	84	79	NR	T+F	all unconstrained in C, all VV constrain in CL	NR	mode of tibia in C was 6, mode of tibia in CL was 11.5, mode of Femur in C was 12.5, mode of Femur in CL was 12.5	No
Lachiewicz[12]	2020	34	50	72	68	61.9	T+F	47% constrained in C, 53% unconstrained in C, 52% constrained in CL, 48% unconstrained in CL	24% I in C, 58% II in C, 18% III in C, 40% I in CL, 54% II in CL, 6% III in CL	92% of CL was 10, 85% of C was 10	No
Jacquet[6]	2021	33	66	109.2	72.7	NR	T+F	all were hinged	6% I in C, 84% II in C, 10% III in C, 10% I in CL, 72% II in CL, 18% III in CL	C was 6, CL was 10	Short Stem in Cemented group with trabecular metal cone in hinge rTKA
Kemker[13]	2022	40	93	25.8	63.8	64.6	T+F	NR	NR	NR	no
Mills[4]	2022	10	10	120	63.5	70	T+F	NR	only in AORI I/II	NR	long-term follow up of the RCT
Miralles-Muñoz[5]	2022	31	42	75.6	66.3	60.2	T	All were unconstrained	61% no defect in C, 29% I in C, 10% II in C, 69% no defect in CL, 26% I in CL, 5% II in CL,	in all was 6	Aseptic tibial revision
Laudren[14]	2022	51	99	87.6	66.5	50.6	T+F	all were VV constrained	39% I in C, 41% II in C, 20% III in C, 67% I in CL,	10 cm femur of C in 23, 15.5 cm femur of C in 1, 10 cm femur of CL in 45, 15.5 cm femur of CL in 6,	no

									30% II in CL, 3% III in CL	10 cm tibia of C in 27, 15.5 cm tibia of C in 0, 10 cm tibia of CL in 43, 15.5 cm tibial of CL in 5	