

COMPARATIVE ANALYSIS OF TIBIAL COMPONENT ALIGNMENT METHODS IN TOTAL KNEE ARTHROPLASTY: IMPACT ON RADIOLOGICAL ALIGNMENT AND SHORT-TERM PATIENT OUTCOMES

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Article Info	ABSTRACT
Received 23/10/2021	The study aimed to assess the accuracy of different alignment guides for positioning the
Revised 16/11/2021	tibial component in total knee arthroplasty and evaluate short-term patient outcomes. A
Accepted 19/12/2021	comparison was made between the intramedullary and extramedullary alignment jigs in 52
· ·	cases of Triathlon total knee arthroplasty. Radiological alignment and patient outcomes
Key words:-	were analyzed. Results indicated that the intramedullary jig resulted in significantly more
Knee arthroplasty,	accurate coronal alignment ($p = 0.03$), while the extramedullary jig yielded more accurate
Intramedullary	sagittal alignment ($p = 0.05$). However, there were no significant differences observed in
alignment,	WOMAC or SF-36 scores at the six-month follow-up. The findings suggest that for optimal
Extramedullary	positioning of the tibial component using this knee system, the intramedullary jig is
alignment, Tibial	preferable.
component.	

INTRODUCTION

Proper alignment of prostheses significantly influences the long-term viability of total knee arthroplasty. Component misalignment has been associated with unfavorable outcomes in studies [1]. Alignment guides play a pivotal role in achieving accurate and precise bone cuts to ensure optimal component placement. Notably, a varus tibio-femoral alignment in TKA was linked to a substantial failure rate of 91% [2], while valgus alignment had a significantly lower rate of 11%.

The optimal alignment guide for tibial component placement remains uncertain. While the differences between the two alignment systems are marginal for most patients, challenges arise for those with substantial soft tissue envelopes impeding extramedullary guide use, and patients with tibial deformities, fractures, or retained metalwork who may be unable to employ an intramedullary guide.

Corresponding Author Dr. Sudheer Kumar Reddy The primary objective of our study in total knee arthroplasty was to identify the superior alignment guide for tibial component positioning. Additionally, we aimed to discern any distinctions in short-term patient outcomes.

MATERIALS & METHODS

Four Orthopedic surgeons performed 52 consecutive total knee arthroplasty (TKA) on 48 patients. All cases were diagnosed with primary osteoarthritis. A tibial deformity did not preclude the use of an intramedullary jig. The Triathlon knee system was used in all cases for cemented total knee arthroplasty. Most of the patients (43 knees) had posterior stabilised prostheses, while the rest had cruciate retaining implants. A tourniquet was applied above the knee during spinal anaesthesia. Every case was approached from the medial parapatellar angle. An intramedullary jig was used to determine femoral alignment. It is recommended to use either an extramedullary alignment jig or an intramedullary alignment jig depending on the surgeon's preference in determining tibial alignment. The posterior slope of the tibial cutting block was set at 3° on the



extramedullary jig, whereas the posterior slope was 0° on the intramedullary jig. A standard rehabilitation protocol was followed for all patients. In addition to age, gender, and BMI, demographic data was collected

During the 6-month follow-up, standing knee radiographs were obtained from all patients in both anterior-posterior (AP) and lateral views. An unbiased assessor, unaware of the alignment jig employed during surgery, meticulously assessed the coronal and sagittal alignment of the tibial components. The mean alignment value was computed based on three measurements, with axis deviation measured in relation to the tibial mechanical axis. Patient outcome data were collected using the Bluespiers clinical software, recorded within Microsoft Excel, and then subjected to comprehensive statistical analysis. A p-value exceeding 0.05 was considered indicative of statistical significance.

RESULTS

A total of 52 total knee arthroplasties (TKAs) were conducted, out of which 18 cases employed an intramedullary jig. No significant discrepancies emerged between the two groups regarding age, gender, BMI, or hospital stay duration. The implementation of intramedullary jigs yielded no complications.

In terms of coronal alignment of tibial components, the intramedullary group displayed a mean deviation of 1.8° , while the extramedullary group exhibited 2.6° . A statistically significant distinction was

evident (p = 0.03). Importantly, all patients within the intramedullary group showcased alignment within two standard deviations of the mean, in contrast to the extramedullary group which had several outliers.

Considering alignment concerning the mechanical axis, the intramedullary group exhibited an average deviation of 3.6° , while the extramedullary group's deviation was 4.7° . However, this variance did not yield statistical significance (p = 0.08). Notably, the extramedullary group demonstrated a greater incidence of outliers.

Accuracy evaluation of the extramedullary jig revealed a 1.7° deviation from the intended 3° cut for sagittal alignment, accounting for correction based on the cutting jig used. Conversely, the intramedullary jig's accuracy was notably diminished and demonstrated statistical significance (p = 0.05).

Both preoperative and postoperative assessments of WOMAC and SF-36 scores were conducted. No significant disparities were observed between the two groups in terms of preoperative WOMAC and SF-36 scores. After the operation, the intramedullary group showed a noteworthy enhancement of 11.6 points in the WOMAC score and 12.9 points in the SF-36 score. Similarly, the extramedullary group displayed an improvement of 22.7 points. Despite these variations, statistical significance was not achieved (p<0.07) in the contrast between the two groups.

Fable 1: Demographics of the Patient.			
	Extra-Medullary	Intra-Medullary	
Total TKA	34	18	
Mean age	66.7	66.7	
Mean BMI	31.8	31.7	
Mean LOS	9.3	10.7	

Table 2:	Alignments	of Tibial	Components.
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Coronal Alignment	Scores	P value
Intramedullary	1.8	0.03
Extramedullary	2.6	
Sagittal Alignment		
Intramedullary	3.6	0.08
Extramedullary	4.7	
Sagittal Corrected		
Intramedullary	3.3	0.05
Extramedullary	1.7	

Table 3: Outcome Scores for Patients.

	Extra-Medullary	Intra-Medullary	P =
Pre woman	45.7	43.4	0.7
6 month woman	23.6	31.6	0.07
Change	22.7	11.6	
Pre sf-36	39.4	39.6	0.8
6 month sf-36	61.9	52.3	0.07



Change	-22.7	-12.9	

DISCUSSION

This study engaged a group of four surgeons who evaluated tibial component alignment in similar patient cohorts. For assessing coronal alignment, the intramedullary guide demonstrated greater reliability. Despite a minor discrepancy of just one degree, the extramedullary guide exhibited more dependable posterior slope cuts. Interestingly, patient outcomes appeared unaffected by the choice of alignment jig, regardless of which one was utilized.

The impact of component alignment on patient outcomes has been established in prior research. Utilizing parameters like sagittal femoral, coronal femoral, rotational femoral, sagittal tibia, coronal tibia alignment, and femurotibial mismatch, this study identified a significant enhancement in short-term patient outcomes when alignment errors were minimized [3]. The data suggests that the use of intramedullary jigs decreases the likelihood of outliers, a benefit associated with the concept of Navered TKA [4]. Consequently, the incorporation of computer navigation hasn't shown a reduction in revision risk for total knee arthroplasty [5].

When determining tibial alignment, 75.6% of British orthopaedic surgeons favored extramedullary jigs, while 20.3% preferred intramedullary jigs [6]. Existing literature doesn't distinctly favor one type of jig over the other. A retrospective analysis of 55 patients showed no alignment disparity between intramedullary and extramedullary TKAs. Conversely, through a randomized prospective trial, Reed et al. demonstrated that intramedullary guides surpassed extramedullary guides in determining tibial coronal alignment [8]. This study further ascertained the intramedullary guide's reliability for coronal alignment assessment, revealing no outliers but an average deviation of 1.6 degrees from the mechanical axis. The alignment method employed exhibited relative indications. Obese patients, as highlighted by Lozano et al., saw unaffected tibial component alignment regardless of the guide type, although intramedullary guides did reduce tourniquet times [9].

Using transesophageal echocardiography, conventional intramedullary instrumented total knee procedures have revealed occasions when fat or intramedullary embolic particles intermittently and unpredictably access the heart's right atrium [10]. In the realm of clinical practice, these incidents generally result minimal consequences. However. situations in characterized by notable extraarticular deformities, marked bowing, previous surgeries, or fractures may necessitate the utilization of extramedullary guides and intraoperative radiographic control [11].

CONCLUSIONS

Research findings support the notion that incorporating an intramedullary alignment jig results in improved accuracy of coronal alignment for the tibial component in total knee arthroplasty (TKA). Conversely, the extramedullary jig exhibited heightened precision for sagittal alignment. Importantly, there were no substantial differences in short-term patient outcomes. To achieve optimal alignment of the tibial component, we recommend prioritizing the use of an intramedullary alignment jig.

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