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Is There a Difference Between Posterior-Stabilized, Cruciate-Retaining, or Medial-Pivot Implants Used During Primary Total Knee Arthroplasty?

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Is there a difference between posterior-stabilized, cruciate-retaining, or medial-pivot implants used during primary TKA?

Response/Recommendation: Based on a network meta-analysis of randomized control trials, there is a lack of definitive evidence to suggest a meaningful difference in outcomes between posterior-stabilized, cruciate-retaining, or medial-pivot total knee arthroplasty implants. While some minor trends in data suggested possible differences between these implants, results were not statistically significant and would likely not surpass clinically meaningful cutoffs. Due to this, surgeon preference and clinical decision-making should be the determining factors behind implant choice when considering these three options.

Level of Evidence: Level 1 - network meta-analysis of randomized trials

Consensus Voting:

Agree – 76.6%.

Disagree – 15.8%.

Abstain – 7.7%.

Rationale

We identified a total of 22 randomized controlled trials (RCTs) that compared posterior-stabilized, cruciate-retaining, or medial-pivot total knee arthroplasty implants through a systematic literature search, with 2,528 patients enrolled across the included studies [1–22]. The Grading of Recommendations Assessment, Development, and Evaluation extension for network meta-analyses (NMAs) was utilized to provide an overall certainty in the evidence for each comparison [23]. While numerous RCTs have been published comparing these different implant designs, the pooled

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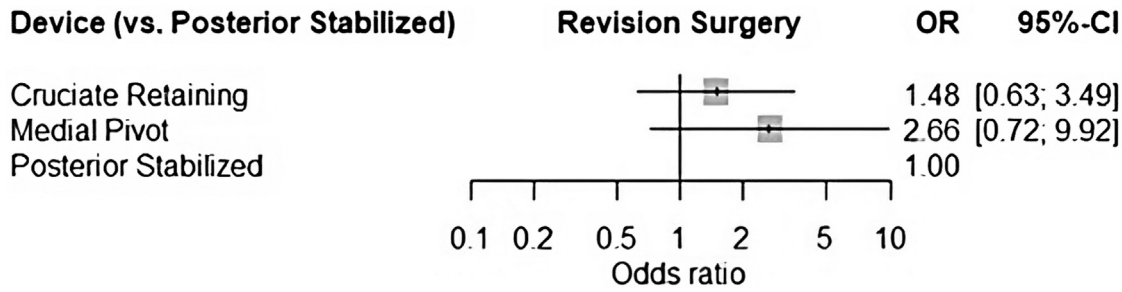

Figure 1. Forest Plot of Revision Surgery.

comparisons demonstrated similar revision rates, complication rates, short-term functional improvements, and long-term functional improvements between these three implant types. Any differences are likely to be small in magnitude and not surpass clinically meaningful thresholds. All three options had favorable safety profiles, as the total revision rate was 1.2% and the total complication rate was 6.9% across all studies included. There were no statistically significant differences in short- or long-term functional improvement.

Revision Rates

As previously stated, the overall revision rate across the included studies was 1.2% at the latest study follow-up. The NMA comparison provided no statistically significant differences between the three options (Figure 1). When compared to posterior-stabilized implants, cruciate-retaining (odds ratio (OR): 1.48, 95% confidence interval (CI): 0.63 to 3.49, $P = 0.37$, moderate certainty) and medial-pivot implants (OR: 2.66, 95% CI: 0.72 to 9.92, $P = 0.14$, moderate certainty) were comparable regarding implant revision rates. Although the result was not significant, the NMA treatment ranking suggested that posterior-stabilized implants were the best option with respect to revisions, followed by cruciate-retaining, and finally medial-pivot implants.

Complication Rates

There were no significant differences in complication rates between the three implant designs (Figure 2). When compared to posterior-stabilized implants, cruciate-retaining (OR: 1.03, 95% CI: 0.64 to 1.66, $P = 0.91$, high certainty) and medial-pivot implants (OR: 1.47, 95% CI: 0.81 to 2.69, $P = 0.21$, moderate certainty) had similar complication rates. The NMA ranking suggested that posterior-stabilized implants had the best complication rate, while medial-pivot implants had the worst. It is unlikely that there will be a meaningful difference in complication rates between these implant designs.

Short-Term Function (3 to 6 Months after Surgery)

Of the 22 RCTs identified, only eight investigations reported functional improvements between three to six months [1,2,5,6,11,17,19,21]. There were no significant differences between these implants regarding short-term functional improvement (Figure 3). Cruciate-retaining total knee arthroplasty had the best NMA ranking, which trended toward a better short-term functional improvement than posterior-stabilized implants (standardized mean difference [SMD]: 0.23, 95% CI: −0.03 to 0.50, $P = 0.09$, low certainty), but was not significant. Similarly, medial-pivot implants were ranked as the second-best option (SMD: 0.17, 95% CI: −0.14 to

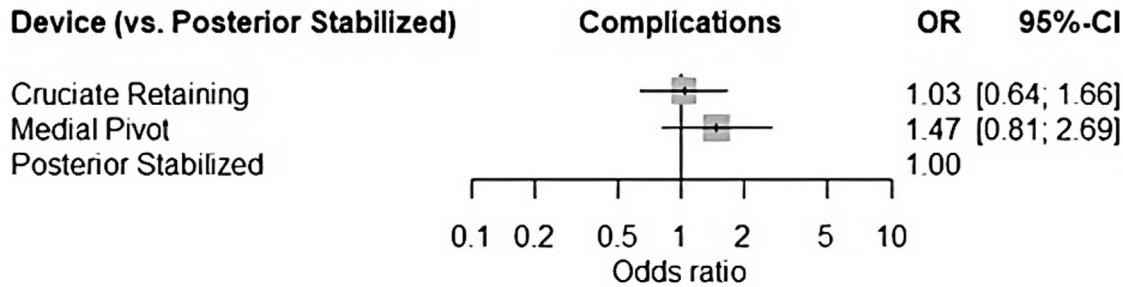

Figure 2. Forest Plot of Complications.

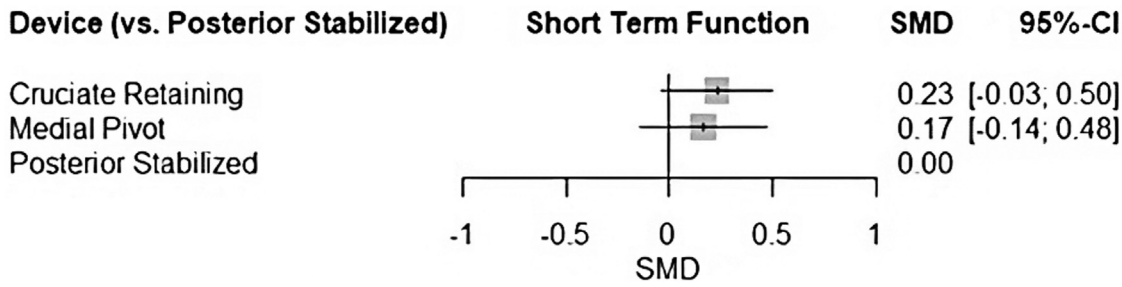

Figure 3. Forest Plot of Short-Term Function.

0.48, $P = 0.28$, low certainty). Posterior-stabilized implants were ranked the worst for short-term functional improvements.

Long-Term Function (> 1 Year after Surgery)

There was no difference between the three implant designs regarding long-term functional improvement, which was reported in 21 out of 22 included RCTs (Figure 4) [1–11,13–22]. Posterior-stabilized implants were ranked the best in terms of long-term function, although they were not significantly better than cruciate-retaining (SMD: −0.13, 95% CI: −0.41 to 0.14, $P = 0.34$, moderate certainty) or medial-pivot (SMD: −0.14, 95% CI: −0.40 to 0.11, $P = 0.28$, moderate certainty) implants.

Strengths and Limitations

This review is strengthened by the robust nature of NMA. The analysis allows for comprehensive comparison across all three implants, inferring possible differences from both the direct and indirect evidence. The NMA also allows for treatment rankings, which provide additional insight into the potential trade-offs of the implant types. Despite the robust nature of this analysis, it is not without limitations. The use of treatment rankings is beneficial but should be interpreted with caution. These NMA rankings suggest a "best" and "worst" implant for every outcome, even when differences between those outcomes may not be statistically significant. This ranking is based on the magnitude of the effect but does not consider confidence intervals. For that reason, the treatment rankings are beneficial to include as supplemental information but should not be used to solely drive conclusions or clinical decision-making.

Conclusions

Based on an NMA of available RCTs comparing posterior-stabilized, cruciate-retaining, or medial-pivot implants; there are small, statistically insignificant, and clinically unimportant differences between these implants with regard to revision rates, complication rates, and knee functional scores at short- and long-term follow-up. Surgeon preference and clinical decision-making should be the determining factors behind implant choice when considering these three options.

CRediT authorship contribution statement

Mark Phillips: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Project

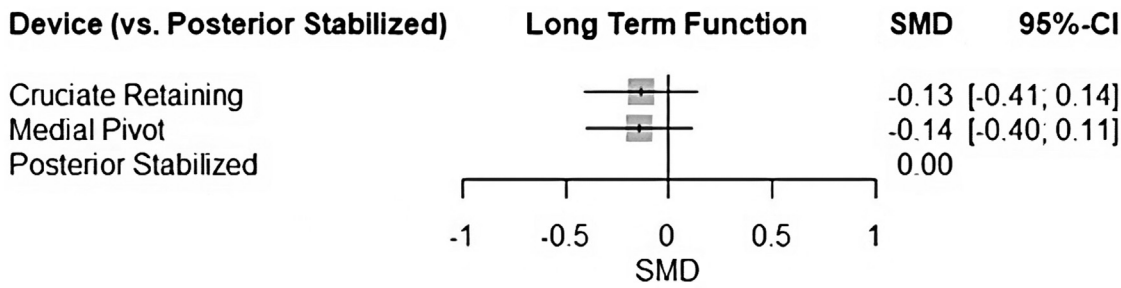

Figure 4. Forest Plot of Long-Term Function.

administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Charles Davis:** Writing – review & editing, Data curation. **Roberto Civinini:** Writing – review & editing, Data curation. **Ayman Ebied:** Writing – review & editing, Data curation. **Lisandro Carbo:** Writing – review & editing, Data curation. **Anant Mahapatra:** Writing – review & editing, Data curation. **Micheal Ong:** Writing – review & editing, Data curation. **Seper Ekhtiari:** Writing – review & editing, Supervision, Methodology, Data curation, Conceptualization.

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