Is There Evidence Supporting the use of All Polyethylene Tibial Components in Primary Total Knee Arthroplasty?

Hamidreza Yazdi, , Eslampour A, Fragas T, Haghbin M, Hernandez V, Omidian M, Sadek FZ, Tarabichi S, Umer M.

Response/Recommendation:

Mid- and long-term follow-up studies indicate that all-polyethylene tibial (APT) components offer significant cost savings and perform excellently across various patient demographics, including age, BMI, and probably activity level. The survival and revision rates, complications, and functional scores of APT components are comparable to those of metal-backed tibial (MBT) components. However, specific concerns, such as the inability to fine-tune knee balancing post-cementation, the lack of stemmed options, and the inability to undertake debridement, antibiotics, and implant retention (DAIR) in early infections, should be considered.

Level of evidences: Moderate

Rationale:

Early designs of total knee arthroplasty (TKA) primarily utilized APT components, with studies from that era reporting survival rates exceeding 90% at long-term follow-up for both cruciate-retaining (CR) and posterior-stabilized (PS) designs with APT components [1-7]. Early aseptic loosening, often due to poor surgical techniques or design [8-13], led to the introduction of MBT components in the 1970s, offering theoretical advantages such as modularity, which allows for intraoperative flexibility and isolated polyethylene liner exchanges without disturbing tibial fixation [14, 15]. However, designs, components, and surgical techniques in applying APT have improved dramatically over the years, leading to better clinical outcomes and increased use among orthopaedic surgeons. To evaluate the outcomes of APT components, studies with mid- and long-term follow-ups, including meta-analyses, randomized controlled trials (RCTs), and retrospective and prospective cohort studies published in reputable journals, were reviewed.

APT components demonstrate good to excellent survival and revision rates comparable to MBT components [15-46]. These results were consistent across different age groups [24, 32, 37, 39-41, 47-51], with reports from the Total Joint Replacement Registry and other large-scale studies confirming satisfactory outcomes and a low risk of revision in patients under 65 years [37, 40]. The APT technique also demonstrated satisfactory outcomes among active patients[26, 37, 39-41, 51]. Most studies evaluating the effect of BMI on outcomes found that both APT and MBT components performed similarly [37, 43, 52-55]. Notably, some studies indicated that APT components had better results in morbidly obese patients (BMI > 40) [24, 29].

APT components also exhibit favorable functional scores [22, 23, 25, 27-29, 31, 33, 34, 36, 39, 41, 42, 45, 46, 50, 51]. Their use in TKA can reduce hospital charges and save costs [8, 27, 32, 34, 36, 40, 45, 46, 56-62] The complication rates associated with APT components in primary TKA, such as infection, osteolysis, periprosthetic fractures, component migration, and wound complications, are acceptable [20, 21, 24, 25, 27, 29-31, 33, 35, 37, 39, 40, 42-46, 63]. The design and performance of APT components in TKA show promising results, particularly in long-term implant survival and patient satisfaction, but their success is closely linked to design and surgical technique [2-6, 8, 9, 12, 13, 20, 23, 30, 37, 49, 60, 61, 63-99]. Many RCT studies also confirm the above results [26,33,60,66,75]. However, patient-specific factors and potential limitations must be considered when selecting APT components. Notable limitations include the inability to fine-tune knee balancing post-implantation, the lack of stemmed options, and the inability to undertake DAIR in early infections [20, 100, 101]. But these concerns are mitigated by the lower infection rates reported with APT constructs [20, 21, 24, 25, 27, 29-31, 33, 35, 37, 39, 40, 42-46, 60, 63, 65, 66].

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