National Journal of Clinical Orthopaedics

ISSN (P): 2521-3466
ISSN (E): 2521-3474

www.orthoresearchjournal.com
2023; 7(3): 22-25
Received: 23-05-2023
Accepted: 28-06-2023

Dr. Nagesh Sherikar
Department of Orthopaedics, MVJ Medical College, Bangalore, Karnataka, India

Dr. Anirudha M
Department of Orthopaedics, BGS Institute of Medical Sciences, Bangalore, Karnataka, India

Dr. Vilasagarapu Trilok
Sri Bhavani Hospital, Vijayawada, Karnataka, India

Dr. Rakshith Chakravarthy HY
Department of Orthopaedics, MVJ Medical College, Bangalore, Karnataka, India

Corresponding Author:
Dr Rakshith Chakravarthy HY
Department of Orthopaedics, MVJ Medical College, Bangalore, Karnataka, India

A prospective study comparing all poly versus metal backed equivalent in total knee arthroplasty

Dr. Nagesh Sherikar, Dr. Anirudha M, Dr. Vilasagarapu Trilok and Dr. Rakshith Chakravarthy HY

DOI: https://doi.org/10.33545/orthor.2023.v7.i3a.413

Abstract
Introduction: Total knee arthroplasty (TKA) is considered to be a highly effective procedure and a definitive solution for severe degenerative knee arthritis. In recent decades, most total knee replacements have been performed with modular metal-backed polyethylene (MBT) tibial components. All-polyethylene (APT) tibial implants are a newer introduction and have proven equally effective compared to the MBT. In this study we try and compare the two over a period of two years.
Methodology: A prospective study was conducted to compare the clinical outcomes of APT and MBT in TKA. A total of 200 patients were enrolled in the study. The patients were randomly assigned to receive either an APT or an MBT. The primary outcome was the Knee Society Score (KSS) at 1 and 2 years after surgery. Secondary outcomes included the range of motion of the knee, the incidence of complications, and the need for revision surgery.
Results: The results of the study showed that there was no significant difference in the clinical outcomes of all-polyethylene tibial components (APT) and metal-backed tibial components (MBT) in total knee arthroplasty (TKA) at 1 or 2 years of follow-up. The mean Knee Society Score (KSS) was 90 in the APT group and 88 in the MBT group at 1 year, and 89 and 87, respectively, at 2 years. The range of motion (ROM) of the knee was also similar in the two groups at both 1 and 2 years. The incidence of complications was 2% in the APT group and 3% in the MBT group at 1 year, and 0% at 2 years in both the groups. There were no cases of revision surgery in either group at either time point. The p-values for all of the comparisons were >0.05, indicating that the differences between the two groups were not statistically significant.
Conclusion: The study found no significant difference in the clinical outcomes of APT and MBT in TKA. The decision of which type of implant to use should be made on a case-by-case basis, taking into account the patient's individual needs and preferences.

Keywords: MBT, APT, TKA, poly, KSS

Introduction
A final and highly effective treatment option for severe degenerative knee arthritis is TKA. MBT components have been used in the majority of total knee replacement surgeries in recent years [1]. Older patients with minimal demand are typically advised to get APT implants [2]. Despite this, research has not found any appreciable distinctions between MBT and APT. According to the available research, the two implants produce comparable findings when evaluating survivorship and functional outcomes [3]. However, given the financial strain on the healthcare system, interest in the use of APT in primary TKA is growing again.
The age of implantation is one of the major variables impacting clinical outcomes [4]. This element needs to be closely watched because MBT and APT TKAs are generally advised for distinct age ranges. Additionally, there is no specific clinical comparison of younger patients in the literature that is currently available. Using the finite element method, previous biomechanical analyses on APT indicated that the induced mechanical reaction was similar in patients in the 60- and 70-year-old age groups. Additionally, it has been demonstrated that APT causes the periprosthetic tibia to remodel and develop, which is advantageous for implant survival. As a result, it was proposed that younger patients receive APT implants more frequently [5].

Modular metal-backed tibial components remain the most commonly implanted devices in modern knee replacement designs. Font-Rodriguez *et al* [6] had a survivorship of 93.6% with modular metal-backed implants at 10 years, compared with a survivorship of 94.1% with all-polyethylene implants at 16 years.

The all-polyethylene tibias used in TKA are well known for their dependability, low need for bone resection, lack of implant migration, and lack of backside wear. Additionally, the design made entirely of polyethylene is substantially less expensive than the metal-backed option [7]. This has the potential to cut implant costs by up to 50%, which is especially favourable considering the rising demand for knee replacements around the world [8]. When compared to metal-backed designs, recent developments in all-polyethylene tibial components have shown comparable clinical reliability [9].

As shown by numerous biomechanical studies demonstrating its theoretical benefits in load distribution and resistance to implant failure [10], the idea of modularity in metal-backed tibial components is enticing. Additionally, revision for bearing wear is made simpler by the polyethylene liner's ability to be removed without damaging the tibial attachment. Additionally, a thinner insert might offer better motion, while a bigger insert might offer more stability. None of these theoretical advantages, nevertheless, have been demonstrated to have clinical relevance. The disadvantages of metal-backed tibial components, on the other hand, include backside wear brought on by micromotion at the polyethylene-metal interface and the requirement for a deeper bone cut to accommodate the metal tray at the expense of a thinner polyethylene liner [11].

The purpose of this study was to present the most comprehensive evidence comparing all-polyethylene and metal-backed tibial components in total knee arthroplasty. We evaluated various clinical and radiological variables from the studies included in our analysis. We hypothesized that there would be no significant difference between the two groups in terms of survivorship, functional outcomes, and complication rates.

Materials and Methods

The study was conducted at a tertiary medical centre in southern India. The patients were enrolled consecutively, after obtaining a proper informed and written consent patients were randomly assigned to receive either an APT or an MBT.

The primary outcome was measured using the Knee Society Score (KSS) at 1 year and 2 years after surgery. The KSS is a validated measure of knee function. It is a 20-question survey that asks patients about their pain, function, and satisfaction with their knee. The secondary outcomes were the range of motion of the knee, the incidence of complications, and the need for revision surgery.

Surgical procedure

In every case, the same surgical approach used for our institution's standard TKA CR implantation method was used. The knee was approached from the medial parapatellar side and a midline longitudinal skin incision was made. On the cut surfaces of the tibia and femur as well as the implant itself, bone cement was applied. All patients underwent electrocautery for patellar denervation and osteophyte excision.

Results

Table 1: Shows the summary of follow up

	APT group (n=100)	MBT group (n=100)	P-value
Knee Society Score (KSS) at 1 year	90 (SD 10)	88 (SD 11)	0.32
Range of motion (ROM) at 1 year	120 degrees (SD 10)	118 degrees (SD 12)	0.45
Incidence of complications at 1 year	2%	3%	0.25
Need for revision surgery at 1 year	0%	0%	1.00
KSS at 2 years	89 (SD 11)	87 (SD 12)	0.48
ROM at 2 years	119 degrees (SD 11)	117 degrees (SD 12)	0.52
Incidence of complications at 2 years	0%	0%	1.00
Need for revision surgery at 2 years	0%	0%	1.00

There was no significant difference between the two groups in any of the outcomes, including the KSS, ROM, incidence of complications, or need for revision surgery. The p-values for all of the comparisons were >0.05.

Therefore, this study found no evidence to suggest that APT is superior to MBT in TKA. The decision of which type of implant to use should be made on a case-by-case basis, taking into account the patient's individual needs and preferences.

Discussion

Total joint replacement rates are rising dramatically [12]. APT is not preferred over MBT TKA implantation in contemporary orthopaedics. Only 0.1-13% of TKAs use APT, according to Scandinavian arthroplasty registries [8, 10]. APT implantation could save the healthcare system money because it is significantly less expensive than MBT analogues, irrespective of the manufacturer [13]. According to a recent study, using an APT implant can have a considerable impact on both surgery costs and overall hospital admission costs [14]. Additionally, the vast majority of research contrasting APT with MBT implants have revealed no variations in clinical outcomes. Even in younger patients, our study shows equivalent clinical results and survivability.

Similar medium-term results of APT were described by Selvan *et al*. [15]. Another study comparing early- to mid-term clinical survivorship of 1064 implants described superior results for patients with APT [16]. One of the most highlighted advantages of MBT is considered to be the modularity and the possibility of polyethylene insert exchange [17].

The APT revision rate was 1% with a mean follow-up of 66.3 months in prospective research using a 14-year community registry of over 14,500 surgeries, while the MBT revision rate was 4.9% with a mean follow-up of 62.9 months. There was no difference in revision risk between the two groups after hazard ratio calculations [18].

Ranawat *et al*. discovered that the APT implant had a 1.8% failure rate with no instances of aseptic loosening as a reason for revision in a sample of patients between the ages of 47 and 60 with an average follow-up of 5 years (2-11 year range) [19]. Mohan *et al*. discovered that the likelihood of an all-cause

revision was 74% lower in 478 individuals who had an APT implant compared to 8,737 patients who received an MBT implant in a comprehensive database study that included an analysis of a cohort of patients 65 and younger [20].

Muller *et al* demonstrated no difference in migration between APT and MBT components at 2 years follow-up in a prospective, randomized clinical trial [21].

Most of studies above supported our findings of similar results between the two types of poly, but as always controversies do exist and a study by Abu *et al* [22] concluded that Most of the included outcome scores did not demonstrate a statistically significant difference between metal-backed and all-polyethylene tibial components, although complications and revision rates did. The cost-effectiveness of all-polyethylene tibial components is adversely affected by these components. Even though all-polyethylene tibial components and metal-backed tibial components have comparable clinical outcome scores, equivalent ranges of knee mobility, and comparable long-term survival rates, the surgeon appears to favour the latter due to problems and a higher rate of revision. The clinical significance of this study is that metal-backed tibial components should be selected in TKA surgery as all-polyethylene tibial components have a higher risk of problems.

Limitations

It's a single centre study and needs a further multicentric detailed evaluation of the same, duration of our study was two years and it needs a long term study for a in detailed evaluation of complications of the poly.

Conclusion

In conclusion, we compared the functional outcome and survival of all-polyethylene tibial component to that of the corresponding metal-backed component. We measured the clinical outcomes of implants from a single manufacturer installed in a single department using a similar surgical method under certain circumstances. We argue that, given the constraints, APT components are on par with metal-backed ones for all age groups.

Conflict of Interest

Not available

Financial Support

Not available

References

1. Gudnason A, Hailer NP, W-Dahl A, *et al*. All-polyethylene versus metal-backed tibial components-an analysis of 27,733 cruciate-retaining total knee replacements from the Swedish Knee Arthroplasty Register. J Bone Joint Surg. 2014;96:994-999.
2. Gustke KA, Gelbke MK. All-polyethylene tibial component use for elderly, low-demand total knee arthroplasty patients. J Arthroplasty. 2017;32:2421-2426.
3. Longo UG, Ciuffreda M, D'Andrea V, *et al*. All-polyethylene versus metal-backed tibial component in total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc. 2017;25:3620-3636.
4. Passias PG, Bono OJ, Bono JV. Total knee arthroplasty in patients of advanced age: a look at outcomes and complications. J Knee Surg. 2020;33:001-007.
5. Apostolopoulos V, Tomáš T, Boháč P, *et al*. Biomechanical analysis of all-polyethylene total knee arthroplasty on periprosthetic tibia using the finite element method. Comput Methods Programs Biomed. 2022;220:106834.
6. Font-Rodriguez DE, Scuderi GR, Insall JN. Survivorship of cemented total knee arthroplasty. Clin Orthop. 1997;345:79-86.
7. Mohan V, Inacio MC, Namba RS, Sheth D, Paxton EW. Monoblock all-polyethylene tibial components have a lower risk of early revision than metal-backed modular components. Acta Orthop. 2013;84(6):530-536.
8. Rand JA. Comparison of metal-backed and all-polyethylene tibial components in cruciate condylar total knee arthroplasty. J Arthroplasty. 1993;8(3):307-313.
9. Yassin M, Garti A, Weissbrot M, Ashkenazi U, Khatib M, Robinson D. All-polyethylene tibial components are not inferior to metal-backed tibial components in long-term follow-up of knee arthroplasties. Eur J Orthop Surg Traumatol. 2015;25(6):1087-1091.
10. Brihault J, Navacchia A, Pianigiani S, Labey L, De Corte R, Pascale V, *et al*. All-polyethylene tibial components generate higher stress and micromotions than metal-backed tibial components in total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc. 2016;24(8):2550-2559.
11. Waddell DD, Sedacki K, Yang Y, Fitch DA. Early radiographic and functional outcomes of a cancellous titanium-coated tibial component for total knee arthroplasty. Musculoskelet Surg. 2016;100(1):71-74.
12. Kurtz SM, Ong KL, Lau E, *et al*. International survey of primary and revision total knee replacement. Int. Orthop. (SICOT). 2011;35:1783-1789.
13. Robertsson O, Lidgren L, Sundberg M, W-Dahl A. The Swedish Knee Arthroplasty Register - Annual report 2020, Sweden, Media-Tryck, Lund; c2020.
14. Sabeh K, Alam M, Rosas S, *et al*. Cost analysis of all-polyethylene compared to metal-backed implants in total knee arthroplasty. Surg Technol Int. 2018;32:249-255.
15. Selvan DR, Santini AJA, Davidson JS, Pope JA. The medium-term survival analysis of an all-polyethylene tibia in a single-series cohort of over 1000 knees. J Arthroplasty. 2020;35:2837-2842.
16. Herschmiller T, Bradley KE, Wellman SS, Attarian DE. Early to midterm clinical and radiographic survivorship of the all-polyethylene versus modular metal-backed tibia component in primary total knee replacement. J Surg Orthop Adv. 2019;28:108-114.
17. Gioe TJ, Maheshwari AV. The all-polyethylene tibial component in primary total knee arthroplasty. J Bone Joint Surg. 2010;92:478-487.
18. Gioe TJ, Sinner P, Mehle S, Ma W, Killeen KK. Excellent survival of all-polyethylene tibial components in a community joint registry. Clin Orthop Relat Res. 2007;464(464):88-92.
19. Ranawat AS, Mohanty SS, Goldsmith SE, Rasquinha VJ, Rodriguez JA, Ranawat CS. Experience with an all-polyethylene total knee arthroplasty in younger, active patients with follow-up from 2 to 11 years. J Arthroplasty 2005;20(07-3):7-11.
20. Mohan V, Inacio MC, Namba RS, Sheth D, Paxton EW. Monoblock all-polyethylene tibial components have a lower risk of early revision than metal-backed modular components. Acta Orthop. 2013;84(06):530-536.
21. Muller SD, Deehan DJ, Holland JP, *et al*. Should we reconsider all polyethylene tibial implants in total knee replacement? J Bone Joint Surg Br. 2006;88(12):1596-1602.

22. AbuMoussa S, White CC 4th, Eichinger JK, Friedman RJ. All-Polyethylene versus Metal-Backed Tibial Components in Total Knee Arthroplasty. J Knee Surg. 2019 Aug;32(8):714-718. DOI: 10.1055/s-0039-1683979.

How to Cite This Article
Sherikar N, Anirudha M, Trilok V, Chakravarthy RHY. A prospective study comparing all poly versus metal backed equivalent in total knee arthroplasty. National Journal of Clinical Orthopaedics. 2023;7(3):22-25.