The Outcomes of Cemented vs. Cementless Total Knee Arthroplasty in Modern Day Patients with Osteoarthritis

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Abstract

Osteoarthritis (OA), the degeneration of cartilage and bone, is the most progressive musculoskeletal disease and a leading cause of disability in the United States, affecting over 27 million adults. Although conservative treatments for knee OA are available, total knee arthroplasty (TKA) is the only definitive treatment for end-stage knee OA. For the past several decades, the use of bone cement has been the gold standard for total knee arthroplasty, but the cementless TKA is being revisited as an option as the age of patients seeking TKA decreases and the average BMI increases. This review analyzes and compares the outcomes of cemented versus cementless TKA in today's average patient with end-stage OA.

Introduction

Osteoarthritis of the Knee

Overview
- Degeneration of cartilage and bone (tibial plateaus, femoral condyles, menisci, patellae)
- Joint space narrowing, osteophyte formation, exposed bone, bone cysts, and subchondral sclerosis

Symptoms
- Knee joint pain
  - Worse with activity; relieved with rest
- Swelling
- Limited range of motion (ROM)
- Crepitus

Treatment
- Conservative: Acetaminophen/NSAIDs, intraarticular corticosteroid injections, platelet-rich plasma injections (PRP), physical therapy, supplementation
- Partial or total knee arthroplasty
  - Cemented TKA most commonly used
  - Cementless TKA more recently studied as a more effective alternative (especially in younger patients with higher BMI)

Methods

- Literature Search
- Performed from August 2021 to January 2022
- Search terms
- Exclusion criteria
  - Reviews
  - Animal clinical trials
  - Age 30 or younger
  - Studies only focusing on TKA
  - Studies only focusing on hybrid TKA
  - Published prior to 2005
  - Studies in a foreign language

Results

1. Adam J. Miller et al. Results of Cemented vs Cementless Primary Total Knee Arthroplasty Using the Same Implant Design, The Journal of Arthroplasty, Volume 33, 2018.
- Retrospective study compared outcomes of 200 cemented versus 200 cementless TKA
- Focusing on participants undergoing TKA with a high body mass index (BMI) and increased activity level, due to younger age

2. Sinicrope BJ, Feher AW, Bhimani SJ, et al. Increased Survivorship of Cementless versus Cemented TKA in the Morbidly Obese. A Minimum 5-Year Follow-Up. *J Arthroplasty*. 2019.
- RCT of 193 participants designed to compare the outcomes of cemented versus cementless TKA
- Collecting data from participants with a high BMI

3. Duffy GP, Berry DJ, Rand JA. Cement versus cementless fixation in total knee arthroplasty. *Clin Orthop Relat Res* 1998.
- Prospective study comparing the outcomes of 59 cemented and 59 cementless TKA over a 10 year period

4. Bercovy M, Beldame J, Lefebvre B, et al. A prospective clinical and radiological study comparing hydroxyapatite-coated with cemented tibial components in total knee replacement. *J Bone Joint Surg Br* 2012.
- RCT designed to compare the outcomes of 157 hydroxyapatite (HA) coated, cementless TKA and 164 methylmethacrylate cemented TKA
- Identifies dangers of methymethacrylate bone cement

Study	Sample Size		Survivorship		Failure Rate		Aseptic Loosening	
	Cemented	Cementless	Cemented	Cementless	Cemented	Cementless	Cemented	Cementless
Miller et al.	200 TKA: Mean age: 64 years Mean BMI: 33.9%	200 TKA: Mean age: 64 years Mean BMI: 33.1%	--	--	4%	3.5%	2.5%	0.05%
Sinicrope et al.	85 TKA: Mean BMI 45%	108 TKA: Mean BMI: 45.6%	88.2%	99.1%	4.6%	25.8%	0.09%	0%
Duffy et al.	59 KTA 52 participants total	59 TKA, 50 participants total	94%	72%	3.3%	16.9%	--	--
Bercovy et al.	164 TKA	157 TKA	99.1%	99.1%	0.06%	0.06%	--	--

Discussion

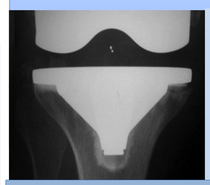
2 of 4 studies suggest that cementless TKA have equal or greater outcomes in terms of failure and survivorship than cemented TKA in modern day patients with end-stage OA requiring surgical intervention.

All studies report equal or greater improvements in pain, functionality, and radiologic findings in cementless TKA compared to cemented TKA.

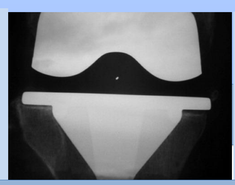
Strengths
- Adequate sample sizes
- Consideration for BMI and activity level
- Adequate outcomes assessment tools

Limitations
- Lack of long term data
- Not accounting for other outcomes measurements
- Patient noncompliance

Future Research
- Cost effectiveness
- Long term survivorship
- In terms of pain, functionality, and radiolucency



Cemented TKA 9 years post-operatively (left)



HA cemented TKA 8 years post-operatively (right)

Conclusion

The study results support that cemented TKA should not be the only definitive surgical treatment when considering TKA. It is reasonable and possibly advantageous for younger, more active patients with a higher BMI to consider cementless TKA, given the success in this population. More research needs to be completed to gather more outcomes data and establish long term survivorship rates of cementless TKA. There is not yet enough data to support a change in the gold standard, but there is enough evidence to justify further research.

Overall, this meta-analysis yields positive results, but the evidence is insufficient to change current practice without further research.

References (further references available upon request)
1. Adam J. Miller et al. Results of Cemented vs Cementless Primary Total Knee Arthroplasty Using the Same Implant Design, The Journal of Arthroplasty, Volume 33, 2018.
2. Sinicrope BJ, Feher AW, Bhimani SJ, et al. Increased Survivorship of Cementless versus Cemented TKA in the Morbidly Obese. A Minimum 5-Year Follow-Up. *J Arthroplasty*. 2019.
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4. Bercovy M, Beldame J, Lefebvre B, et al. A prospective clinical and radiological study comparing hydroxyapatite-coated with cemented tibial components in total knee replacement. *J Bone Joint Surg Br* 2012.
5. Aprato A, Risitano S, Sabatini L, Giachino M, Agati G, Massè A. Cementless total knee arthroplasty. *Ann Transl Med*. 2016;4(7):129.

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Bercovy								