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Article – Clinical Medicine**Exploring the Importance of Implant Selection in Total Hip Arthroplasty**

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Introduction

Total Hip Arthroplasty (THA) is a rapidly growing field within the United States. In 2023 alone, 1,050,821 arthroplasties were performed, making it the second-most performed arthroplasty of the year.¹ With over a million of these procedures completed each year, there are several medical device companies that create their own implants to be used in these procedures. Each company can patent their own device and go through a thorough process involving the FDA to receive approval provided there is evidence from clinical trials that demonstrates their device improves patient outcomes.² With the many implant options available, one question to consider is whether a specific medical device, compared to another one, is more prone to better patient outcomes in surgical operations. This review aims to provide information about the process of selecting the optimal hip prosthesis for a total hip arthroplasty candidate and include whether certain implants lead to better patient outcomes than others.

Discussion

Cementless Stems represent a majority of THA operations, with 79.26% of THAs in 2022 being done without cement.¹ In 2023, a retrospective registry-study assessing the long-term survival and complication rate of cementless stems indicated that among the 6 Mont-system classifications of cementless stems. The stem types include single wedge (1), double wedge (2), tapered round (3A), tapered spine/cone (3B), tapered rectangle (3C), cylindrical fully coated (4), modular (5), or anatomic (6) (Figure 1). Results revealed there was a significant difference in implant survival rate of the hip arthroplasties, with single wedge type 1 implants having the lowest failure rate (1.6%) and anatomic type 6 implants having the highest failure rate (3.9%).³ While this study indicates a significant difference and includes 53,626 patients, the study is a retrospective observational study, which means it is of a lower evidence threshold of information, indicating that other literature may contain better evidence that can further support or refute the conclusion of this study.

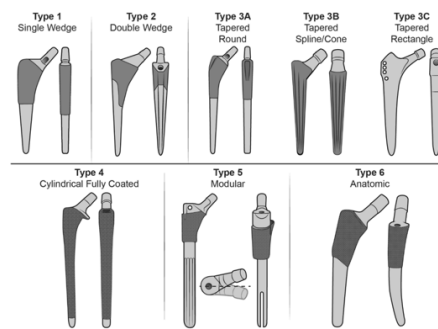


Figure 1. The Mont-system classification of cementless stems.

A meta-analysis completed in 2007 comparing cemented versus cementless fixation in THA indicated no advantage was found for either type of procedure. In this study, failure was defined as a need for revision in either a specific or both components. However, there was a superior survival of cemented fixation in patients of all ages compared to patients 55 or younger, suggesting that cemented hip implantation can be more advantageous in the older population. Twenty articles were used with studies ranging from 82 to 79,135 implants examined. This study also indicated an increase in superiority over time of uncemented fixation, suggesting improvements have been made to the implants themselves.⁴ While this article was published 17 years ago and does not necessarily correspond to current technology, it does emphasize how between 1966 and 2005 there was innovation in THA implants, reinforcing the importance of innovation and clinical trials in new implants that can lead to better outcomes.

Another meta-analysis published in 2013 comparing cemented and cementless fixation indicated a better short-term clinical outcome for cemented fixation based on pain score. However, the study also found unclear results related to long-term clinical outcomes or implant survival based on revision or radiographic findings. The article also found no difference or correlation was evident in mortality, post operative complications, or in radiographic findings.⁵ This study reinforces the results in the other meta-analysis that cemented THA were efficacious in their role within THA operations, as their short-term outcomes were superior. This study used only RCTs to assess implantation efficacy, highlighting its strength, yet its publication date of 10 years ago suggests more current data must be used to evaluate the conclusions drawn in the article.

In 2021, the Journal of Bone and Joint Surgery published a meta-analysis reviewing whether implant selection impacts patient-reported outcomes after THA operations. The study attempted to review the

odds of having inadequate improvement, failure to achieve substantial clinical benefit, or failure to achieve patient-acceptable symptomatic state based on function and pain comparing the type of implant used in the THA. The study revealed that implant selection was not a significant reason of inadequate improvement in any category measured. In addition, stem format or geometry was not seen as a significant factor of patient outcomes as well.⁶ As a result, physicians can select whatever implant is readily available in the hospital that they are comfortable using.

While innovation in THA is important to improve patient outcomes, it is also important to always consider the existing literature and acknowledge that newer implants are not always better. A systematic review published in 2014 assessing 5 new and widely used implants in both THA and total knee replacement (TKR) did not support the usage of these materials that were already implemented throughout orthopaedics, suggesting that existing devices may be safer during THA and TKR operations.⁷ The conclusion of this data indicates a flaw within the orthopaedics community, as new technology can sometimes be adopted without sufficient evidence that it improves patient outcomes. Phase IV clinical trials are key to assessing the efficacy of implants to ensure that there are benefits to implants given to patients.

Conclusion

The literature present related to selection of implants for THA suggests a potential better outcome for cemented TKAs in short term, yet mainly reveals that there is no major difference between different implant devices. As a result, each company that creates their own implants will also be required to maintain a competitive pricing on their THA implants as well, as several physicians may select implants that cost less if implants are similar in results. Projections of Medicare patients suggest an increase in THA procedures to 176% growth by 2040 and 659% growth by 2060, revealing the importance to improve the procedure as much as possible.⁸ As the demand for THA grows, it is likely that the efficacy of implants and drive to innovate orthopaedic devices will continue to improve patient outcomes as well.

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