

Critical Evaluation of the Fixation and Longevity Achieved with Porous-Coated Uncemented Total Knee Replacements

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Abstract

Limitations of cemented total knee replacement (TKR) designs have led to a desire for improved longevity. Uncemented TKRs have demonstrated potential as a viable alternative especially for younger and more active patients. The development of specifically structured, porous surface coatings for these TKRs is vital to the advancement of this technology. Porous coatings enhance an implant's ability to achieve better fixation with bone. Osseointegration is affected by the manipulation of micro- and nano-surface roughness of the porous implant surfaces, which cause changes in cell adhesion and osteoblast proliferation and differentiation. Enhanced fixation through bone ingrowth has helped reduce micromotion, aseptic loosening due to osteolysis, and stress shielding. Two commercial coatings are discussed, namely Zimmer's porous tantalum *Trabecular Metal* and Stryker's *Tritanium* and Peri-Apatite coating. An assessment of different uncemented knees reveals improved survivorship that surpasses the gold standard set by cemented TKRs. In particular, uncemented TKRs reported 97.5% survivorship at 12-year follow-up for patients whose average age was 50.7 years. Varying results indicate a need for continued trials to validate the long-term success of uncemented TKRs. With the added information gathered from these trials, uncemented TKR design has the potential to be optimized in a way that will improve longevity and prevent early revision for patient's who wish to return to an active and pain free lifestyle.

1. Introduction

1.1. Clinical Relevance

Throughout the past fifty years, total joint arthroplasty has become one of the most commonly performed and highly effective orthopaedic procedures [1]. Total knee arthroplasty (TKA) is the standard of care in the treatment of end-stage degenerative joint disease of the knee [2]. Recent studies have indicated that the number of total knee replacements (TKR) performed in the U.S. will increase dramatically over the next two decades [3,4]. In 2010 alone, more than 700,000 TKRs were performed in the U.S., a number that is expected to reach nearly 3.5 million by the year 2030 [3,4]. This massive increase is largely attributed to the baby boomer generation who wish to retain their active and healthy lifestyles as they age, as well as a rise in conditions that contribute to arthritis, particularly obesity [2]. An important distinction in this population of potential TKR recipients is the increasing number of patients younger than 60 years who are being operated with TKA [5]. In general, younger people are more active than older patients and therefore usually put higher stresses on the implants [5]. This places younger patients at a higher risk of revision compared to older patients, and consequently presents a new challenge to design implants and modes of fixation that will last longer to suit the younger patients' lifestyles [5].