Different Methods of Implant Fixation in Primary Knee Arthroplasty

Essay

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بسم الله الرحمن الرحيم

وقُلِ اعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ وَرَسُولُهُ والْمُؤْمِنُونَ

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Karim Mostafa El Melegy

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List of Abbreviations

Abbr.	Full-term
BMI	: Body mass index
DVT	: Deep vein thrombosis
HA	: Hydroxyapatite
MGI	: The Miller-Galante I
Mpa	: Megapascals
PMMA	: Polymethyl methacrylate
RCT	: Randomized controlled trial
RSA	: Radiostereometry analyses
TKR	: Total knee replacement
UHMWP	: Ultrahigh molecular weight polyethylene
UKA	: Unicompartmental knee arthroplasty
WOMAC	: Western Ontario and McMaster Universities Arthritis

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Abstract

Purpose: Discuss and compare the recent advances of different methods of implant fixation of knee arthroplasty

Methods: Comprehensive literature review was performed using cemented, cementless and hybrid TKR regardless the year of publication.

Results: Cemented TKR has the upper hand over the other methods in outcome, low rate of complication, stability and cost.

Conclusion: Newest generation of cementless TKR treat the complication of oldest generation.

Keyword: outcome, complication, stability and cost.

Introduction

Total knee arthroplasty performed worldwide uses either cemented, cementless, or hybrid (cementless femur with a cemented tibia) fixation of the components. Noncemented components offer the potential advantage of a biologic interface between the bone and implants, which could demonstrate the greatest advantage in long-term durable fixation in the follow-up of young patients undergoing arthroplasty.[1]

There was a significant gender difference between cemented and cementless TKR (total knee replacement), with males having a higher failure rate with cemented fixation. Females had a similar failure rate with cemented and cemetless fixation.[2]

Cementless fixation provides improved fixation at five years compared with cemented fixation in mobile-bearing unicompartmental knee replacements, maintaining equivalent or superior clinical outcomes with a shorter operative time and no increase in complications.[3]

radiographic analysis using antero-posterior X-rays revealed significantly more and larger periprosthetic loosening areas in tibial zone 2 in the patient undergo cementless TKR.[4]

Oxford Knee and American Knee Society scores were comparable in the cemented versus cementless cohorts. Statistical analysis revealed no significant difference in peri-prosthetic bone mineral density.[5]

Aseptic loosening of cemented knee arthroplasties has encouraged development of uncemented fixation. The Miller-Galante I (MG I) prosthesis was designed to achieve permanent stability through ingrowth into a titanium fiber mesh. Patellofemoral problems, especially avulsion of the polyethylene from the metal-backed patella occur occasionally. Severe metallosis is the main reason for revision. Metal-backed patellar component should be avoided.[6]

A significantly higher revision rate was found in the uncemented compared with cemented total knee arthroplasty of the Press Fit Condylar design due to aseptic loosening and osteolysis.[7]

Cementless femoral fixation was excellent in its initial results, however, metal-backed patellar components had a 48% patellar revision rate. Cementless tibial components had an 8% aseptic loosening rate and a 12% incidence of small osteolytic lesions. Based on these results, many authors have abandoned cementless fixation in total knee arthroplasty.[8]

Addition of cement surrounding the tibial stem decreases micromotion of the tibial tray in cemented total knee arthroplasty. However, if the cement mantle beneath the tibial baseplate was increased to 3 mm, excellent stability of the implant was seen regardless of whether the tibial stem was left uncemented. In this particular component design, implant stability was enhanced with the addition of cement surrounding the tibial stem unless the cement mantle beneath the tibial tray was increased to 3 mm.[9]

There was no difference in cumulative revision rate based on diagnosis (OA versus other) or age group or between cruciate-retaining and substituting designs. Eighty five percent of cemented TKA implants survived at 14 years in the population under 55 years of age. Cementless designs and UKA increased revision risk independently.[10]

Although cemented tibial fixation of total knee arthroplasty accepted as the gold standard, cementless fixation as a means to avoid many of the disadvantages of cemented fixation, which continues to be of interest to clinicians. No osteolysis was identified in either group. The rate of survival of the femoral and tibial components

was 100% in both groups at final follow up in study mulhall et al.[12]

In the study by Cosetto D.J et al there were no significant differences in the clinical and radiological outcomes between the cemented and cementless over a minimum of 8-year postoperative period. This study has shown that both tibial fixation methods in mobile-bearing TKA resulted in good clinical and radiological outcomes during their follow-up period, and no patient underwent revision of the any component of TKA.[11]

In patients under the age of 60 years using the NexGen cruciate retaining TKA, there were no significant differences in outcome both clinically or radiologically or on radiostereometric analysis when comparing a cemented with an uncemented femoral component. The RSA (Radiostereometry analyses) findings suggest that an uncemented and non- hydroxyapatite (HA)-coated femoral component may behave equally as well as a cemented one in the long term.[12]

Aim of the Work

The aim of this work to discuss and compare the Recent advances of different methods of implant fixation of knee arthroplasty.

Anatomy of the Knee

- **Structure**
  - 1.1 Articular bodies
  - 1.2 Articular capsule

- **Muscles**
  - 2.1 Extensors
  - 2.2 Flexors

- **Blood supply**