

The use of short femoral stem in Total hip replacement

This is submitted for the fulfillment of master degree in
Orthopedic Surgery

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2010

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Acknowledgment

First of all I would like to thank Allah the good and the merciful for all blessings given to me throughout my life.

I would like to thank Professor Ahmed Morrah for all his support, knowledge and co-operation and I would like to thank Doctor Sherif Khaled for his help, patience and his great efforts.

I would like to thank my mother who exerts great and unbelievable efforts with me all the time. God save her all the time. This work I dedicate it for the soul of my father who always gives me spiritual support all the time.

ABSTRACT

Total hip replacement is considered one of the most successful operations in orthopedic surgery .

Short femoral stems tend to solve problems occurring with traditional stems like stress shielding and bone resorption. Short femoral stems give better results in young age with physiological loading and minimal bone loss and minimal soft tissue loss

KEY WORDS

total hip replacement

Short femoral stem

Physiological loading

Aim of the work

Aim of this work is to provide a recent study and informations about the design, technique and the use of short femoral stem implants.

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List of abbreviations:

THR	Total hip replacement
OA	Osteoarthritis
AVN	Avascular necrosis
RA	Rheumatoid arthritis
DDH	Developmental dysplasia of the hip
PMMA	Polymethylmethacralyte
HMWPE	High molecular weight polyethylene
TARA	Total articular replacement arthroplasty
MIS	Minimal invasive surgery
MOM	Metal on metal
COC	Ceramic on ceramic
TPP	Thrust plate prosthesis
BMD	Bone mineral density
IPS	Immediate post operative stability

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Introduction

Total hip arthroplasty (THA) is one of the most successful orthopedic procedures performed today. For patients with hip pain, THA can relieve pain, restore function, and improve quality of life. Sir John Charnley, a British Orthopedic surgeon, developed the fundamental principles of the artificial hip and is credited as the father of THA. He designed a hip prosthesis in the mid to late 1960's that still sees use today. It is estimated that over 150,000 total hip arthroplasties are performed each year in the United States and over 500,000 are performed worldwide. THA is a procedure whereby the diseased articular surfaces are replaced with synthetic materials, thus relieving pain and improving joint kinematics and function. ⁽¹⁾

Total hip arthroplasty has become a common procedure with generally good long-term results, although as it is applied to increasingly younger patients, the procedure has shown correspondingly poorer results. It has been suggested that the use of a short stem could conserve proximal bone, such that more bone might be available should a revision procedure become necessary. Furthermore a shorter stem could potentially reduce the extent of proximal stress shielding, a phenomenon that has been associated with bone resorption around traditional stems which can lead to implant loosening. Short-stemmed implants may also facilitate the use of a less invasive surgical approach reporting lower blood loss, shorter operating times and greater bone retention. This could potentially lead to faster post-operative recovery as well as improved long-term implant survival rates. ^(2,3)

Among noncemented femoral components, the short stemmed implants are designed for obtaining mechanical stability in the metaphyseal part of the femur. The rationale for the design of this group of femoral components is to transmit forces from the hip joint to the most proximal part of the femur to maintain as much as possible of the stresses in the bone and reduce the amount of bone resorption that will take place in the proximal femur after total joint arthroplasty. ^(4,5)

An additional rationale for using a metaphyseal filling, proximally textured or porous- coated femoral prosthesis is to preserve the endosteum of the diaphysis. ⁽⁵⁾

The use of these new short stemmed implants is done with a new and special technique of insertion to facilitate the insertion and to protect the gluteus muscles. Many clinical and experimental results were encountered to evaluate the result of these short implants revealing good postoperative stability, no thigh pain and less complication than ordinary stems. ⁽⁵⁾

History of total hip replacement

Total hip replacement (THR) is considered of the most successful operations in orthopedic surgery for alleviating pain, disability and helping patients getting back to their normal life style. Humans suffer from various hip joint problems namely osteolysis, osteoarthritis, avascular necrosis, rheumatoid arthritis, other inflammatory arthritis, developmental dysplasia, and others. ⁽¹⁾

Some diseases lead to hip disability and these diseases include: Osteolysis: It is local loss of bone tissue and appears because of wear. Destruction of bone takes place especially by bone resorption through removal or loss of calcium. Osteolysis may be evident in neoplastic, infectious, metabolic, traumatic, vascular, congenital and articular disorders. ⁽²⁾ Osteoarthritis (OA): It is a degenerative arthritic disease, a “wearing out”, involving the breakdown of cartilage in the joints and is one of the oldest and most common types of arthritis. The bones get deformed, and even small movements will cause friction and severe pain (fig 1-1). ⁽²⁾



Fig 1-1 Osteoarthritis of the hip ⁽¹⁾

Avascular Necrosis(AVN): This is caused by lack of blood supply into bone leading to bone death. If avascular necrosis progresses, bone and the surrounding joint surface may collapse causing OA and increase in pain.⁽²⁾ Rheumatoid Arthritis (RA): This involves inflammation in the lining of the joints and/or other internal organs. RA produces chemical changes in the synovium that cause it to become thickened and inflamed. In turn the synovial fluid destroys cartilage. Fracture neck of Femur: incidence of fracture is higher in old age. Developmental Dysplasia (DDH) is a condition in which the femoral head has an abnormal relationship to the acetabulum. It includes frank dislocation, partial dislocation (subluxation) or instability of the hip, where in the femoral head comes in and out of the socket (fig 1-2) .⁽²⁾



Fig 1-2 Bilateral DDH ⁽¹⁾

The diseases described above lead to severe disability. As a result people are forced to seek surgeries involving bone replacement in order to get rid of their suffering and keep their joints mobile. ⁽¹⁾

The first attempt to replace the hip joint were made by Gluck from Berlin (Germany) in 1880. The prosthesis was manufactured from ivory but it wasn't successful. A second attempt was made by French surgeon Jules Pean from Paris in 1890 with a prosthesis made from platinum but it also failed. It wasn't till 1923 when Smith Peterson from USA invented new replacement prosthesis and the cup was made of glass as an interpositional arthroplasty between the femoral head and the acetabulum. Unfortunately these glass cups frequently fractured as they couldn't withstand the mechanical demand and eventually led to the use of Vitallium between 1938 and 1948 Smith Peterson performed 500 Vitallium cup arthroplasties reporting a high percentage of satisfactory results. However, all patients required prolonged physical therapy after surgery and surgical revisions were done to improve motion or to relieve pain.⁽²⁾

In 1938 the Judet brothers in Paris invented an acrylic hip prosthesis (fig 1-3) but failed again as it became loose and had to be removed.⁽²⁾



Fig 1-3: First Judet Stem ⁽³⁾

It was obvious that joint replacement couldn't succeed till appropriate materials were found or manufactured till the inventions of a chrome cobalt alloy characterized by high mechanical and surface resistance and also high density polyethylene and bone cement. Initially only the femoral head was replaced using cementless Moore (fig 1-4) and cemented Thompson prosthesis limiting the indications just to femoral neck fractures but it was a highly successful technique still used sometimes nowadays cause it is cheap. ⁽²⁾



Fig 1-4 Austin-Moore Original Prosthesis ⁽³⁾