Bearing Surfaces in Hip Arthroplasty

Essay

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قَالُوا سُبْحَانكَ لاَ عِلِمَ لَنَا إِلاّ مَا عَلّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ

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Introduction

Introduction

The role of the bearing surface has become even more important as patients undergoing arthroplasty seek high-performance prostheses to meet their expectations.

Since joint arthroplasty was first introduced, surgeons and engineers have made adjustments to try to increase its longevity and improve outcomes. One extremely important development is the introduction of a new generation of bearing surfaces. Improvements in design, advancements in manufacturing, and introduction of alternative bearing surfaces have positively affected THA outcomes over recent decades. Introduction of bearing surfaces with better wear characteristics led to a decline in the release of biologically active wear debris and tremendously reduced wear-related failures. Furthermore, availability of better bearing surfaces with increased resistance to wear has allowed orthopedic surgeons to use larger femoral heads, which in turn has led to a substantial decline in the incidence of instability after hip arthroplasty.

Aim of the Work

Aim of work

The aim of this study is to review different bearing surfaces in hip arthroplasty, the recent bearing methods, advantages and disadvantages of these methods.

Chapter -1

Anatomy of the Hip Joint

Anatomy of the Hip Joint

An accurate knowledge of the anatomy of the hip joint is required for any surgeon performing hip arthroplasty.

Knowledge of the osteology of the femur and acetabulum is important for preoperative evaluation, surgical technique, and selection of the prostheses.

Hip joint is a synovial joint of the ball and socket variety, it connects the pelvic girdle with the lower limb. The stability of hip joint is largely the result of the adaptation of the articulating surfaces of the acetabulum and femoral head to each other in addition to very strong ligaments in and around the hip joint that maintain the coaptation of the articular surfaces and limit their range of motion (1).

Bony Anatomy

Proximal femur:

The proximal femur includes the head, neck, lesser and greater trochanters, and proximal femoral diaphysis. The form of the femur is relatively complex, with bowing and twisting that distort its basically tubular structure. The diaphysis of the femur has anterior bowing while the distal portion of it is inclined posteriorly to the knee and the proximal portion inclined anteriorly to the acetabulum (Fig. 1) [(2)].

The head:

The head of the femur is slightly more than half of a sphere and it faces anterosuperomedially to articulate with the acetabulum. Its smooth surface is interrupted by a small rough area called (fovea).

The sheath is pierced by ligamentum teres which extends from the acetabular notch to the fovea, although this intra-articular ligament appears to be in an ideal position to reinforce the hip joint, it is not sufficiently taut during the normal range of motion to provide significant support. Its major function is to convey a small artery to the head of the femur from obturator artery [(3)].

Neck shaft angle:

Femoral neck is about 5cm long in adult; it connects the head to the shaft at an angle known as neck shaft angle. It is the inclination of the neck to the shaft in the frontal plane. It plays an important role in freedom of motion of the hip joint as it offsets the shaft from the pelvis laterally in addition, it lateralizes the abductors, which attach to the greater trochanter, this increases the torque generated by the abductors and reduces the overall force necessary to balance the pelvis.

The adult neck-shaft angle averages 125 degrees (range 106-155). Variations in the neck-shaft angle correlate with the relative position of the trochanters and the femoral head center to the femoral shaft, as the neck-shaft angle increases, the head center lies higher than the greater trochanter and closer to the axis of the medullary canal and the greater trochanteric tip is positioned more lateral to the femoral canal. These relationships change conversely as the neck-shaft angle decreases into varus [(4)].

These have an important implication during hip arthroplasty, as in a varus hip, the tip of the greater trochanter lies medially and often in line with the center of the medullary canal. Lateralization to the trochanteric tip is required to establish the correct entry point for the rasps in order to obtain optimum positioning of the femoral prosthesis [(5)].

Femoral version:

It is the inclination of the neck in the transverse plane; it is formed as a projection of the femoral head and transverse plane of the femoral, condyles. During childhood, this angle progressively decreases until reaches the average adult anteversion of 10-15 degrees, the increase in anteversion beyond this range causes a portion of the femoral head to be uncovered and creates tendency towards internal rotation of the leg during gait (in-toeing) to keep the femoral head in the acetabular