Total Knee Replacement TKR

Sometimes also called ***"resurfacing"***, this operation involves the removal and replacement of the damaged, worn ends of the thighbone (femur), and lower leg (tibia) bones that make up the knee joint, as well as the back of the kneecap (patella).

The posterior cruciate ligament is a tissue that normally stabilizes each side of the knee joint so that the lower leg cannot slide backward in relation to the thighbone. In total knee replacement surgery, this ligament is either retained, sacrificed, or substituted by a polyethylene post.

Arthritis leads to the weight bearing surfaces of the knee joint wearing away. They are no longer smooth and free running and this leads to stiffness and pain. Eventually the joint wears out to such an extent that the bone of the femur (thigh bone) grinds on the bone of the tibia (shin bone). Osteoarthritis often develops in just one compartment of the knee, usually the inner (medial) compartment.

The prosthesis for total knee replacement consist of femoral, tibial, and patellar components as in figure 8. Compared to the hip joint, the knee joint has a more complicated geometry and movement biomechanics, and it is not intrinsically stable.

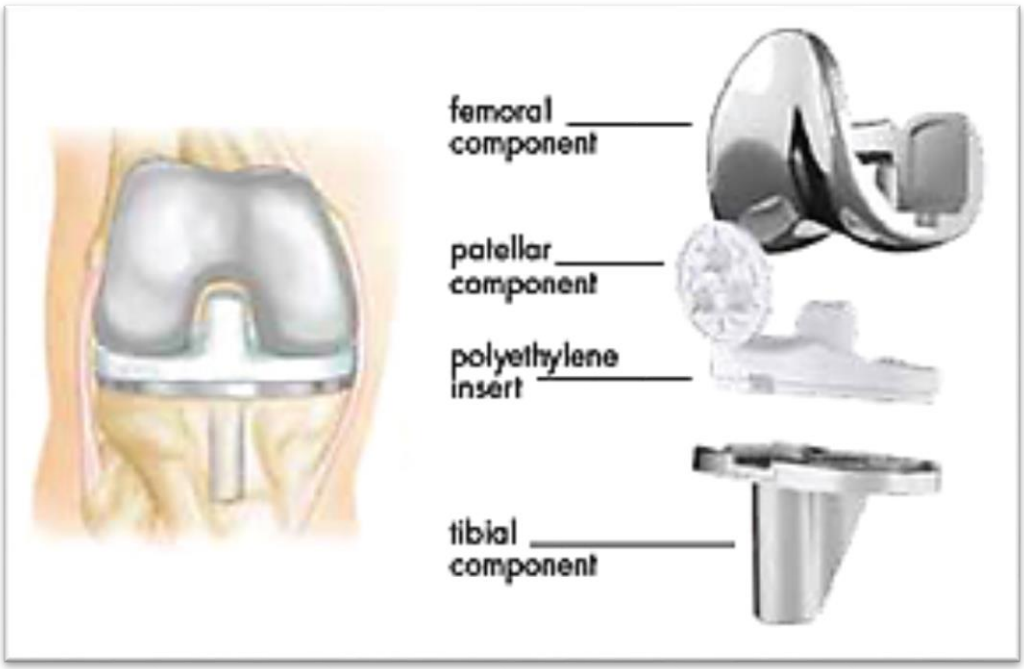

Fig 8 The prosthesis of total knee replacement

Types of the knee prostheses are:

1- Constrained: these implant have a hinge articulation, with a fixed axis of rotation and are indicated when all of the ligaments are absent

2- semi-constrained: these implants control posterior displacement of the tibia on the femur and medial- lateral angulation of the knee.

3- non-constrained: these implants provide minimal or no constraint

The femoral components are typically made of Co-Cr alloy and the monolithic tibial components are made of UHMWPE. In modular components, the tibial polyethylene component assembles onto a titanium alloy tibial tray. The patellar component is made of UHMWPE, and a titanium alloy back is added to components designed for uncemented use. Total knee replacement can be implanted with or without cement, the latter relying on porous coating for fixation. Because of the advantages of ceramic bearing surfaces in terms of superior lubrication, friction, and wear properties compared to Cobalt-Chrome alloy (Co-Cr) surfaces, cemented alumina or zirconia ceramic/UHMWPE have been used in TKR.

Surface lubrication is improved in ceramics because of their hydrophilic nature, lead to decreasing adhesive wear. While the hard surface of ceramic bearings minimizes scratching abrasive wear.

Alumina and zirconia have become the most popular ceramics for use in total joint replacement. Zirconia was introduced in an attempt to further reduce the risks of component fracture and wear particle production. Highly polished ceramics have shown good success as articulating components in total joint arthroplasty- with articulation against either a polymer or another ceramic both possible. The wear rate of YPSZ on UHMWPE can be five times less than the wear rate of alumina on UHMWPE, depending on experimental conditions.