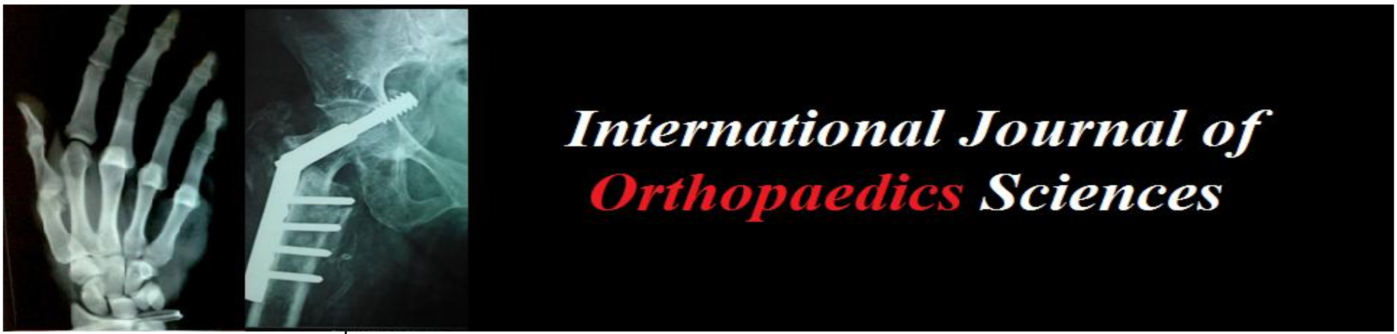

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Ashraf Abd-Eldayem
Lecturer of Orthopedic Surgery
Faculty of Medicine, Zagazig University, Egypt

Hossam Fekry
Lecturer of Orthopedic Surgery
Faculty of Medicine, Zagazig University, Egypt

Ahmed M Mashhour
Lecturer of Orthopedic Surgery
Faculty of Medicine, Zagazig University, Egypt

Correspondence
Ashraf Abd-Eldayem
Lecturer of Orthopedic Surgery
Faculty of Medicine, Zagazig University, Egypt

Long-term results of mobile bearing total knee arthroplasty

Ashraf Abd-Eldayem, Hossam Fekry and Ahmed M Mashhour

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Abstract
Background: Total knee arthroplasty is a successful surgical procedure with a survivorship greater than 90% after 15 years. Preoperative range of motion is believed to have a large influence in the postoperative results. The mobility of the polyethylene insert permits rotation and gliding.
Aims of study is to present the results of a prospective, long-term clinical follow-up of 86 patients were managed with simultaneous bilateral mobile-bearing total knee arthroplasty, and to evaluate their outcome.
Patients and Methods: Patients were followed up for 92 months (range 72-102 months), 32 men and 54 women with average age 63 years. Radiographic evaluation was carried out preoperatively and postoperatively. All procedures were performed by using a standard technique, including the necessary soft-tissue release required to obtain adequate balance. Rehabilitation started on the first postoperative day assisted by a physical therapist with full weight bearing.
Results: Clinical and radiographic evaluations were done on regular bases. Outcomes were measured using the American Knee Society Score and the Oxford Knee Score. The mean improvement in the postoperative arc of flexion was 30°. The average length of physiotherapy before going back to near the normal activities was 23 days. Before surgery, the average Knee Society knee score was 49.7 points and at final follow-up was 86 points. The Oxford knee score was 42 points before surgery and at final follow-up was 24 points. Both scores show significant improvements. Radiologically, the averaged varus was 16° and at final follow up was 6° of valgus. No significant complications were recorded.
Conclusions: not all patients are candidates for mobile-bearing TKA, it has lower the loosening rate, and it has the ability to self-align, moreover that, the surgical technique is of paramount importance during the implantation of a mobile-bearing prosthesis.

Keywords: mobile, bearing, knee, long, term

Introduction

Knee prosthesis is basically the resurfacing of the joint articulating surfaces. For total knee arthroplasty it is desirable to reproduce the natural knee movements and stability from extension to flexion. Total knee arthroplasty (TKA) is a successful surgical procedure with a survivorship greater than 90% after 15 years [13, 15, 57]. Prosthesis life depends on wear rate of ultra-high molecular weight polyethylene (UHMP). Minimum recommended thickness of the UHMP component is 8 mm. If the UHMP is thin, this results in greater stress. Inadequate spacer insertion, poor ligament balancing, excessive bone resection, and/or mal-rotation of the prosthesis can cause dislocation of a total knee arthroplasty.

Preoperative range of motion is believed to have a large influence in the postoperative results. Therefore, improvement of range of motion should be calculated and reported. A satisfactory post-operative range of movement (ROM) is an important feature of a successful total knee arthroplasty [50] (TKA). Significant factors affecting the outcome include pre-operative flexion [1, 35, 47, 56, 64], the tibio-femoral varus-valgus angle [35, 64], the age of the patient [64], body-weight [47], the technique of surgical closure [30], and the design of the implant [28, 49, 64].

According to Kettelkamp *et al.* [43] and Laubenthal *et al.* [46] the normal ROM of the knees is 0° to 140°; 67° of flexion is required in the swing phase of walking, 80° for climbing stairs, 90° for descending stairs and 93° for sitting on a chair. Congruency between the femoral component and the superior surface of the rotating polyethylene in a mobile-bearing design was intended to reduce polyethylene wear, while rotation between the inferior polyethylene

surface and the metal tray was intended to reduce stress on the metal tray and the tibial bone interface [11].
Mobile-bearing posterior-stabilized knee replacements have been developed as an alternative to the standard fixed- and mobile-bearing designs [23]. Recent studies have improved the understanding of the kinematic behavior of the modern total knee replacement [2, 3, 25]. For reduction of polyethylene wear, mobile-bearing prostheses have been introduced that have a high articular conformity to increase the contact area [17, 20, 40, 54, 71]. Rotating-bearing designs may result in lower contact stress and wear because they minimize rotational malalignment between the femoral and tibial components [29]. Rotating-platform, mobile-bearing total knee replacements have been developed to improve knee kinematics, lower contact stresses on the polyethylene tibial component, minimize constraint, and allow implant self-alignment [10].
Goodfellow and O'Connor [33] first proposed the Oxford meniscal-bearing total knee replacement as a more kinematically sound design. Mobile-bearing TKAs initially were developed to decrease the contact stresses on PE and to reduce PE wear. These prostheses were designed to create a dual-surface articulation such that the PE insert that articulates with the metallic femoral component also would have a source of kinematic freedom at the upper surface of the metallic tibial tray on which it rests [53].
Excellent 10-year survivorship has been reported with the LCS rotating platform knee replacement [16-18, 20, 68] (94%-100%). Range of motion has been limited somewhat in this device, Callaghan *et al.* [17, 20] reported a mean postoperative ROM of 102°. In recent years, mobile-bearing total knee arthroplasty has gained a lot of popularity. In mobile-bearing TKA, the polyethylene insert articulates with a metallic femoral component and a metallic tibial tray. Such a dual-surface articulation is designed to gain low contact stress and low constraint forces [14].
The mobility of the polyethylene insert permits rotation and gliding; the load can thus be shared by the soft tissues, and there is less loosening stress being transferred to the bone-prosthesis interface [21]. Fixed-bearing TKA cannot be fully conforming without being exceedingly constrained to axial rotation, transferring large rotational stresses to the prosthesis-bone interface. Mobile-bearing devices can overcome this conformity-axial constraint conflict by allowing unconstrained axial rotation with fully conforming articulations, reducing the axial stress to the prosthesis bone interface [17, 20].
Aims of this study, to present the results of a prospective, long-term clinical follow-up of 86 patients were managed with simultaneous bilateral mobile-bearing total knee arthroplasty, and to evaluate their outcome.

Patients and Methods

From February 2006 to March 2017, 86 consecutive patients were included in the study. Simultaneous bilateral total knee replacement performed on the same day under the same anesthesia in a sequential manner. As a convention, the first operation was always performed on the right knee. Patients were followed up for a minimum of one year. The mean follow-up period was 92 months (range 72-102 months). There were 32 men and 54 women (37.2% and 62.8% respectively). The average age at the time of operation was 63 years (range 47-84). Figure 1 shows age distribution. The underlying knee diseases that led to replacements were osteoarthritis. Body weight average was 79 kg (range 58-121 kg), figure 2 show different weight groups.

Among 86 patients, there were 64 were evaluated as pre-operative cardiology assessment, which prove that most cases has intermediate risk for surgery. The recorded co-morbidity for all patients is shows in figure 3.
The demographic data of the patients shows in table 1.

Table 1: Demographic data for All Patients in Study.

Variable	
Total no. of patients	86
Mean age (range) (yr)	63 (47-84)
Male/female	32/54
Mean duration of follow-up (range) (yr)	3yr (1.5-3.5 yr)

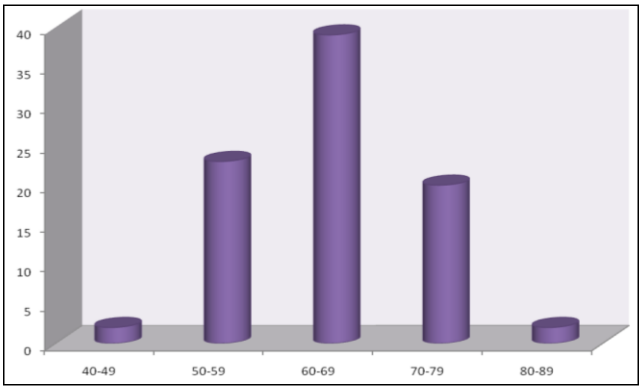

Fig 1: Age distribution

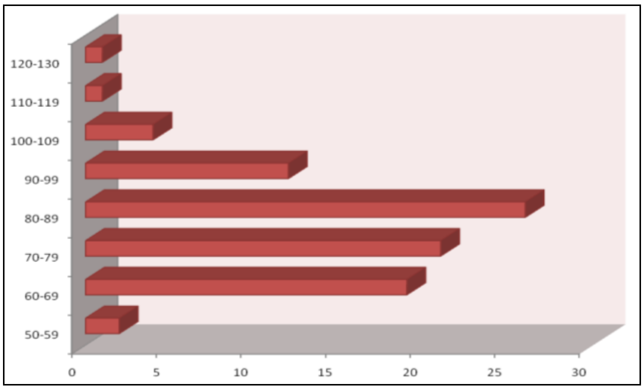

Fig 2: Weight distribution

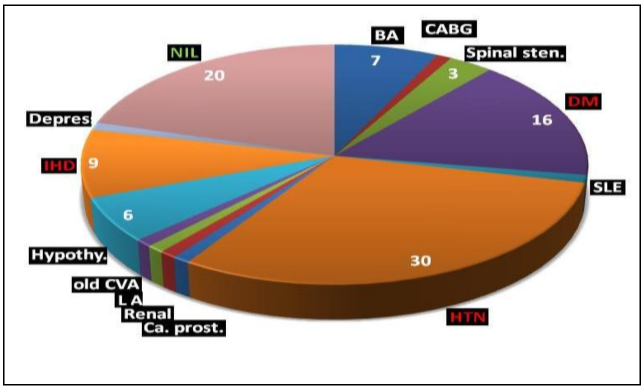

Fig 3: Total co-morbidity for all patients: BA, bronchial asthma; DM, diabetes mellitus; HTN, hypertension; Ca.prost., cancer prostate; LA, latex allergy; Hypothy, hypothyrodism; IHD, ischemic heart desiese; Depres, depression.

Antero-posterior radiographs with the patient standing and supine, lateral radiographs were made preoperatively and postoperatively and were assessed for alignment of the limb, the position of the components, and the presence and location of radiolucent lines at the bone-cement interface.

Radiographic evaluation was carried out on the preoperative and the postoperative radiographs, which included an antero-posterior radiograph made with the patient standing, lateral radiographs made with the patient supine. The overall alignment of the limb, the position of each of the implants, and the location of radiolucent lines at the bone-cement interface were analyzed. A loose prosthesis was diagnosed when there was a progressive lucency of >2 mm surrounding the entire border of the prosthesis, subsidence of the component, or a change in alignment of the prosthesis compared with its immediate postoperative status. Patients with a previous upper tibial osteotomy, patellectomy, retained hardware from a previous juxta-articular fracture, a fixed varus or valgus deformity of more than 20°, or substantial extra-articular malunion of the femur or tibia were excluded from study.

All procedures were performed by using a standard technique, including the necessary soft-tissue release required to obtain adequate balance. Proper intra-operative laxity was judged manually rather than measured. No cases of revision replacement or conversion from a high tibial osteotomy were included in the study.

P. F. C. Sigma rotating platform (RP-F) Knee Replacement [DePuy Orthopaedics, Inc.] was used in all cases (figure 4). RP-F characterized by: refined posterior curve to the femoral condyle, sustained area contact in deep knee flexion, predictable posterior femoral rollback, smooth, curve on curve motion up to 155°, and allows for 20° internal/external rotation without anterior overhang.

Fig 4: Shows the R-PF implant AP and Lat views for both the full assembled prosthesis and the PE

Surgical technique

During surgery the patient was placed in a supine position, leaving both legs freely mobile on the table. We prepared and draped the legs followed by tourniquet inflation. Seventy one patients (82.5%) were received spinal anesthesia, five patients (5.8%) as spinal epidural, and ten patients (11.7%) went under general anesthesia due to difficulties for epidural catheterization and controlled by patient control analgesia after (PCA). All patients get followed an identical postoperative pain protocol, through an epidural catheter. The surgical procedure employed a midline skin incision measuring 12 to 15 cm in length. Ligament and soft-tissue balancing in extension was done. Anterior and posterior femoral cuts were made to ensure a quadrilateral flexion gap, thereby balancing the collateral ligaments in flexion. Care was taken to ensure equal flexion and extension gaps.

Resection of the proximal part of the tibia, which was performed perpendicular to the mechanical axis and was posteriorly inclined to mimic the slope of the tibia. A stepwise ligament release was performed until balanced flexion and extension gaps and a properly functioning posterior cruciate ligament were observed with trial implants in place. The knee was then taken through a range of motion while tracking of the patella was observed. The tourniquet was then deflated, homeostasis was established, and drains were placed. Postoperatively, continuous passive motion was utilized for the duration of hospitalization. The femoral cut was performed with use of an intramedullary guide system providing 3° of external rotation, with the posterior condyles used as a reference. An extramedullary system, with the midpoint of the talus as a reference and with 0° of posterior slope, was used to cut the proximal part of the tibia.

The surgeries were performed under tourniquet control; mean tourniquet time was 48 minutes (range 42-65 min). A medial parapatellar approach was used in all knees. Mean surgery time was 4 hours and 10 minutes for both knees (range 3 hr and 30 min-4 hr and 40 min). The posterior cruciate ligament was released in all knees. The patella was not replaced in any patient; however, a patelloplasty was done in all[42]. Both the tibial and the femoral components were cemented. Lavage of the osseous surface was used before cementing the implants

The intra-operative assessment of patellar tracking was done with the real components cemented into place. The so-called no-thumbs test was used[65], in which the patella was reduced into the trochlea and the knee was put through a range of motion (ROM) test. Appropriate tracking was defined as a patella that remained centered in the trochlea through 90° flexion with no tendency for tilt or subluxation. If the patellar tilt or have subluxation with the no-touch test, then a lateral retinacular release was done. Typically, the lateral retinacular releases were done from the inside out, with care taken to preserve the superior lateral geniculate vessels.

Antibiotic prophylaxis with intravenous cefazolin (2 g given one-half hour before inflation of the tourniquet followed by 1 g every eight hours for three days) and antithrombotic prophylaxis with subcutaneous enoxaparin (40 mg on the night before surgery and 40 mg daily continued through the seventh postoperative day) were used in all patients, followed by warfarin sodium for three more weeks, in combination with compression stockings. Rehabilitation started with continuous passive knee movement (CPM) started at 60º and continued in an increasing manner gradually. Mobilization began on the first postoperative day assisted by a physical therapist with full weight bearing. All patients in this study remained in the hospital and had rehabilitation until safe, double crutch mobilization was possible, ascend several stairs, and flex the knee to 90° or more.

A splint was applied with the knee in 15° of flexion and was worn for the first twenty-four hours after the operation. The knee then was placed in a continuous passive-motion machine. All patients began walking with crutches or a walker and started active and passive range-of-motion exercises on the first day after the operation. The patients used crutches or a walker, with full weight-bearing, for six weeks and then used a cane for six weeks under supervision of physical therapist. Clinical and radiographic evaluations were done at six weeks, three months, six months, and one year after the operation, and then yearly thereafter. Each knee was rated preoperatively and postoperatively according to the systems of the American Knee Society Score [38] (AKSS), and the Oxford Knee Score [22] (OKS).

Outcomes were measured using the American Knee Society Score (AKSS) 0 to 100 points [38], the Oxford Knee Score (OKS) 0 to 48 points [22], and determination of the range of movement and pain scores before and at one year after operation. The Knee Society has proposed this rating system to be simple but more exacting and more objective, the American knee society score (AKSS). The system (table 2) is subdivided into a knee score that rates only the knee joint itself and a functional score that rates the patient's ability to walk and climb stairs. Three main parameters of pain, stability, and range of motion. 100 points will be obtained by a well-aligned knee with no pain, 125" of motion, and negligible antero-posterior and medio-lateral instability. 50 points are allotted for pain, *25* for stability, and 25 for range of motion [38].

The oxford knee score (OKS) consists of 12 questions (table 3), each with five categories of response. Each item is scored from 1 to 5, from least to most difficulty or severity, and combined to produce a single score with a range from 12 (least difficulties) to 60 (most difficulties) [22].

Table 2: American Knee Society Score [38] (AKSS).

Pain	Point
None	50
Mild or occasional	45
Stairs only	40
Walking and stairs	30
Moderate	
Occasional	20
Continual	10
Sever	0
Range of motion	
(5° = 1 point)	25
Stability	
Antero-posterior	
<5 mm	10
5-10 mm	5
10 mm	0
Medio-lateral	
<5°	15
6°-9°	10
10°-14°	5
>15°	0
Subtotal	[ ]
Deductions points (minus)	
Flexion contracture	
5°-10°	2
10°-15°	5
16°-20°	10
>20°	15
Extension lag	
<10°	5
10°-20°	10
>20°	15
Alignment	
5°-10°	0
0°-4°	3 points each degree
11°-15°	3 points each degree
Other	20
Total deductions	[ ]
Total knee score	[ ]

Table 3: Oxford Knee Score [22] (OKS).

S. No	Item During the past four weeks	Scoring categories
1.	How would you describe the pain you usually have From your knee?	1 None 2 Very mild 3 Mild 4 Moderate 5 Severe
2.	Have you had any trouble with washing and drying Yourself (all over) because of your knee?	1 No trouble at all 2 Very little trouble 3 Moderate trouble 4 Extreme difficulty 5 Impossible to do
3.	Have you had any trouble getting in and out of a car Or using public transport because of your knee? (whichever you tend to use)	1 No trouble at all 2 Very little trouble 3 Moderate trouble 4 Extreme difficulty 5 Impossible to do
4.	For how long have you been to walk before the pain From your knee becomes severe? (with or without a stick)	1 No pain/>30 min 2 16 to 30 min 3 5 to 15 min 4 Around the house only 5 Not al all-severe on walking
5.	After meal (sat at a table), how painful has it been for You to stand up from a chair because of your knee?	1 Not at all painful 2 Slightly painful 3 Moderately painful 4 Very painful 5 Unbearable
6.	Have you been limping when walking, because of Your knee?	1 Rarely/never 2 Sometimes or just at first 3 Often, not just at first 4 Most of the time 5 All of the time
7.	Could you kneel down and get up again afterwards?	1 Yes, easily 2 With little difficulty 3 With moderate difficulty 4 With extreme difficulty 5 No, impossible
8.	Have you been troubled by pain from your knee in bed At night?	1 No nights 2 Only 1 or 2 nights 3 Some nights 4 Most nights 5 Every night
9.	How much has pain from your knee interfered with Your usual work (including housework)?	1 Not at all 2 A little bit 3 Moderately 4 Greatly 5 Totally
10.	Have you felt that knee might suddenly “give way” Or let you down?	1 Rarely/never 2 Sometimes or just at first 3 Often, not just at first 4 Most of the time 5 All of the time
11.	Could you do the household shopping on your own?	1 Yes, easily 2 With little difficulty 3 With moderate difficulty 4 With extreme difficulty 5 No, impossible
12.	Could you walk down a flight of stairs?	1 Yes, easily 2 With little difficulty 3 With moderate difficulty 4 With extreme difficulty 5 No, impossible

Results

The mean follow-up period was 36 months (3 yr) (range16 to 39 months). This study present the results of a prospective, mid-term clinical follow-up of 86 patients operated for simultaneous bilateral TKA with P. F. C. Sigma rotating platform (RP-F) Knee Replacement [DePuy Orthopaedics, Inc.]. The mean preoperative arc of motion was 77°±15° (range, 55° to 105°). The mean improvement in the postoperative arc of flexion was 30°±14°. The average loss of motion was 7.2°. The average length of physiotherapy before going back to near the normal activities was 23 days (range 17-54 days).

Knee Society Score (AKSS): Before surgery, the average Knee Society knee score was 49.7 points (range 32-80). The average Knee Society knee score for all the knees at final follow-up was 86 points (range 47-99). Improvement was significant.

Oxford Knee Score (OKS): Before surgery, the average Oxford knee score was 42 points (range 32–51). The average Oxford knee score for all the knees at final follow-up was 24 points (range 13–38). The improvement was significant.

Radiographic Results

The preoperative femoro-tibial alignment (anatomic axis) averaged 16° of varus (range, 10° to 25° of varus) At the time of the final follow up, the femoro-tibial alignment was 6° of valgus (range, 0° to 9° of valgus). Blood transfusion post-operatively in most cases, 75 patients, needed transfusion of two unites packed RBCs and was given.

Complications

Patellar tilt was seen in two knees (right knee in one patient and left knee in another patient) and was associated with mild stiffness and anterior knee discomfort during stair-climbing or rising from a sitting position. Neither of these patients required subsequent surgery during the follow-up period. No deep infection or septic loosening that necessitated implant removal. No complication were recorded as superficial wound necrosis, hematoma needing reoperation, Peroneal nerve palsy, persistent stiffness, partial avulsion of the patellar tendon or an intra-operative medial femoral condyle fracture. At review none of the implants showed radiological signs of loosening or subsidence.

Recorded complication not related to surgery but recorded as co-morbidity was occurred in ten patients (11.6%), figure 5 shows different co-morbidit.

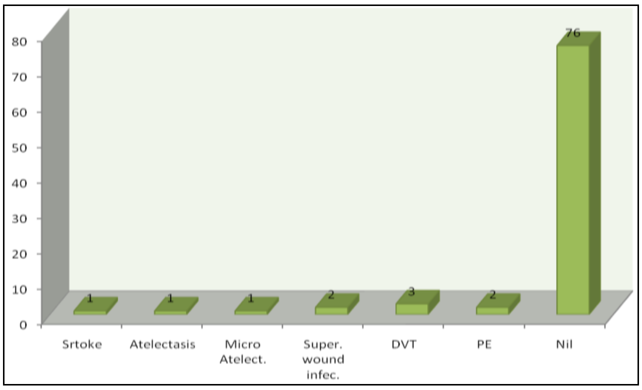

Fig 5: Shows different co-morbidity as post-operative not related to surgery

General out come as patients satisfaction that 83(96.5%) were satisfied and 3(3.5%) as dis-satisfied, 84(97.7%) were have no pain and 2(2.3%) had continuous pain, finally 80(93%) patients return to their previous activities and 6(7%) were not return adequately. Figures (6 to 9) shows example for the pre- and post-operative and follow-up radiological studies. Different results for intra- and post-operative values are shown in the table 4 below.

Table 4: Shows different intra and post-operative parameters

Clinical Data	Mean± SD (range)
Tourniquet time (minutes)	48±8(40-65)
Operation time (minutes)	250±35(210-280 min)
Blood loss (mL)	450±200(220-700 mL)
SLR (postoperative day)	1.4±0.4(1-2)
90° flexion (postoperative day)	1.9±0.7(1-4)
Degrees flexion at 30 days	115±5(90-130)
Degrees flexion at 1 year	120±7(95-140)
Degrees flexion at 3 years	125±8(95-140)

SLR=straight leg raise

Fig 6: Shows pre-op AP standing view and lateral view, and 1 year post-op x-ray for 65 years old female patient

Fig 7: Shows pre-op AP standing view and lateral view, and 3 years post-op x-ray for 65 years old female patient

Fig 8: Shows pre-op AP standing view and lateral view, and post-op x-ray for 67 years old male patient

Fig 9: Shows pre-op AP standing view and lateral view, and post-op x-ray for 61 years old female patient

Discussion

Mobile bearing TKR has some advantages: a) providing a mobile PE insert reduces high contact stress, b) lower contact stress means less fatigue wear, c) less constraint means less risk of loosening, d) allows more conforming tibio-femoral components without risk of increased stress at bone-implant interface. Against: a) high dislocation rate of the bearing prostheses, b) high gravimetric wear due to two bearing surfaces (top of tibial platform against femoral surface and bottom of platform against tibial metallic tray). Infection is a major disaster in any joint replacement. It is important to diagnose early and treat on an urgent basis. It is either superficial or deep infection. No case recorded as deep infection in this study.

Total knee arthroplasty has been found to have good survivorship results fifteen years after implantation in several large multicenter series [51, 58]. Insall *et al.* [39], and Schurman *et al.* [64] reported that the ROM after TKA does not change significantly after one year. This was the same finding in current study. The concept of mobile-bearing knee implants was introduced in the late 1970s by Goodfellow and O'Connor [32]. They proposed that the mobile-bearing design had better kinematics, ROM, function, and durability than the existing fixed-bearing knee implants because of its rotating platform. Theoretically, the additional degree of freedom provided by this design should promote load sharing through displacements between the tibial and femoral components, allowing the torque and shear forces of gait to be transferred to the soft tissue in a similar fashion to that which occurs in the intact knee.

Mobile-bearing TKAs initially were developed to decrease the contact stresses on PE and to reduce PE wear. These prostheses were designed to create a dual-surface articulation such that the PE insert that articulates with the metallic femoral component also would have a source of kinematic freedom at the upper surface of the metallic tibial tray on which it rests [53]. Patellar resurfacing was not done in any of the knees as the presence of a small patella, typical of patients in our part of the world, and the higher rate of lateral retinacular release (thus potentially compromising the vascularity of the patella) would increase the risk of patellar fracture if resurfacing was attempted. This is also reported by Keblish *et al*. [42].

The concern about potential patello-femoral complications has led some surgeons to rethink the treatment of the patello-femoral joint during TKA. Currently in Europe, the majority of patellae are not resurfaced. In the United States, the majority of the patellae are resurfaced [41]. In this study, no resurfacing for the patella was done, rather than patelloplasty and denervation, and no anterior knee pain were recorded. Mobile-bearing posterior-stabilized knee replacements demonstrated greater and more natural internal rotation of the tibia during flexion. Such rotation occurred at the interface between the insert and tibial tray for mobile-bearing posterior-stabilized designs [23]. Delport *et al*. [23] conclude that mobile-bearing posterior-stabilized knee replacements reproduce internal rotation of the tibia more closely during flexion.

Furthermore, mobile-bearing posterior-stabilized knee replacements demonstrate a unidirectional movement which occurs at the upper and lower sides of the mobile insert. The femur moves in an antero-posterior direction on the upper surface of the insert, whereas the movement at the lower surface is pure rotation. Such unidirectional movement may lead to less wear. Bottlang *et al*. [9] from their data suggest that the particular mobile-bearing prosthesis tested potentially reduces elevated strain levels in the proximal tibia. Arthroplasty with a mobile bearing prosthesis could reduce proximal tibia cortex strain and tibial torsion in response to axial and rotational loading [9]. The mobile-bearing mechanism effectively reduced strain in the proximal tibia under combined axial and rotational loading [9].

Mobile-bearing prostheses tolerate axial rotation better by transferring less shear strain to the implant-bone interface. The tolerance to axial rotation also may be more forgiving in case of rotational alignment errors after implant insertion [29, 70]. The reduction in load transmission may be desirable to promote implant integration during the early postoperative phase [9]. With any mobile-bearing knee replacement, dislocation is a potential complication [7, 34, 72]. In this study there was no dislocation recorded. Long term studies [17, 20] showed that mobile-bearing TKA could achieve the objectives of improving the wear resistance and decreasing the loosening rate.

Kim and Kim [44] in their series of 190 patients, there were 11 men and 179 women (5.8% as male and 94.2% as female). This study includes 86 patient 32 male and 54 female (37.2% and 62.8% respectively). Patient expectations after a total knee arthroplasty (TKA) include pain relief, improved ambulatory ability, and improved knee flexion. The amount of flexion achieved postoperatively is determined by the amount of preoperative flexion, especially if the flexion was less than 75° [8, 31, 47]. A goal of TKA includes obtaining a painless ROM between 0°-105° [60, 63]. This study approached this goal in all cases.

The advantages of the mobile bearing TKA are to minimize component loosening and minimize polyethylene wear. At a minimum of 15 years follow-up for cemented rotating-platform mobile-bearing TKA, Callaghan *et al*. [19] reported no knee was revised because of loosening, osteolysis, or wear in their series of 37 patients (53 knees). In this mid-term series of 86 patients, none needed re-operation. Despite many studies demonstrated advantages of using a mobile-bearing knee[19], especially for rotating platform design, several concerns have been expressed including the need for a more exacting surgical technique and the occurrence of bearing dislocation [36]. Sorrells [66, 67] in his series reported dislocation rate less than 3.5% of cases, although Bert *et al*. [7] reported a higher incidence of 9.3%. All of these events occurred in early stage after knee arthroplasty and were attributed to improper surgical technique. In this series no such complication occurred.

Banks *et al*. [3] reported that to increasing ROM is to enlarge the flexion space. This usually is accomplished by using a thinner polyethylene insert or cutting more bone from the posterior femoral condyles. This was the observation in this study. Mostly used PE was 10 mm to 12.5 mm. Contact stress studies have demonstrated rapidly increasing polyethylene stresses with decreases in polyethylene thickness. Current recommendations are to utilize tibial polyethylene inserts with a minimum thickness of 8 mm to avoid rapid increases in polyethylene stresses associated with accelerated polyethylene wear [4, 5]. All cases in this study get tibial insert of a minimum of 10 mm PE.

Dennis *et al*. [26] studied four different designs of mobile-bearing total knee arthroplasty to assess polyethylene bearing mobility patterns and magnitudes. The polyethylene bearing rotation relative to the tibial tray and minimal rotation relative to the femoral component. The average rotation ranged from 8.4° to 10.3°. The presence of bearing mobility should result in lower contact stresses reducing the potential for polyethylene wear. As the knee flexes, the tibia typically internally rotates relative to the femur and externally rotates as the knee extends (*i.e.*, screw-home mechanism) [27, 62]. This mechanism is facilitated to occur with the mobile bearing TKA designs.

Explanation for the low PE wear rates associated with mobile-bearing TKA designs is the decoupling of multidirectional motions occurring at the articular interfaces with rotating-platform TKA designs. In rotating-platform TKA designs that allow no AP translation, the inferior, or tibial tray-PE bearing interface, is designed to have purely rotational motion patterns [24]. Dennis and Komistek [24], concluded that use of meticulous surgical technique and operative strategies include precise ligament balancing, reproducing anatomic extremity alignment, restoring the proper joint line level, and assuring symmetry and balance of the flexion and extension gaps, reduce polyethylene wear after TKA. In this study the previous factors were taken into consideration.

Despite the many theoretical and demonstrated advantages of use of a mobile-bearing TKA, several concerns have been expressed with their use. These include the need for a more exacting surgical technique, bearing instability [12, 36], a risk of enhanced polyethylene wear resulting from creation of a second articulating surface [52], and a concern the micro particulate wear debris created from the undersurface articulation of mobile bearing TKA designs will be smaller and have greater potential to create osteolysis [37, 52]. A circumferential radiolucency adjacent to a prosthetic component is used to define loosening radiographically [61]. The prevalence of radiolucencies may be underestimated because they may be difficult to detect on routine plain radiographs [48]. No radiolucency zoon could be detected in this series of patients. It may be also early to detect such observation as short term follow up.

The mobile-bearing TKA behaved more consistently with a kinematic profile that was close to that of the normal knee [59]. Mobile-bearing knee design has the ability to self-align and, therefore, to accommodate at least small mismatches in the rotational position of the tibial and femoral components after TKA. That process of self-alignment might be expected to improve patellar tracking, decrease the rate of lateral retinacular release and the prevalence of postoperative patellar tilt or subluxation seen on routine radiographic follow-up, and improve maximal knee flexion [55]. It has been stated that proper patellar tracking is critical for a total knee replacement to be well functioning[45]. Poor tracking has been implicated as a source of decreased knee motion, anterior knee pain, and abnormal patterns of implant wear [6]. Surgical technique is of paramount importance during the implantation of a mobile-bearing prosthesis. Instability arising from a failure to achieve soft-tissue balance in both flexion and extension can be major contributors to early failure and osteolysis [69].

Conclusions

Not all patients are candidates for mobile-bearing TKA. Mid-term study showed that mobile-bearing TKA improve the wear resistance and lower the loosening rate. Mobile-bearing knee design has the ability to self-align and, therefore, to accommodate at least small mismatches in the rotational position of the tibial and femoral components after TKA. Surgical technique is of paramount importance during the implantation of a mobile-bearing prosthesis.

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