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The functional outcome after cemented total knee replacement for primary osteoarthritis

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Abstract
Introduction: The use of computer-assistance during surgery has great advantages because many of the traditional, space occupying instruments that are used with traditional surgery are completely eliminated_ Instead, a narrow digitizing probe can be slid into critical areas to measure important factors such as joint surface position and rotation.
Methodology: This was a hospital-based prospective observational study which was done to analyze the functional outcome of Cemented Total Knee Arthroplasty for primary osteoarthritis. 30 patients who consecutively consented and underwent Posterior Cruciate Sacrificing Cemented Total Knee Arthroplasty were assessed clinically and functionally using Knee Society scores.
Results: The difference between the means's of pre-op KCS and post-op KCS was 67.35 (64.56 to 70.14, 95% CI). The P Value was significant (<0.001) when the pre-op and post-op Knee Clinical Scores were compared. The difference between the mean's of pre - op KFS and post - op KFS was 45.40 (41.24 to 49.56, 95% C1). The P value was significant (<0.001) when the pre - op and post — op Knee Functional Scores were compared.
Conclusion: Cemented Total Knee Arthroplasty improves the functional ability of the patient and the ability of the patient to get back to pre-disease state, which is to have a pain free mobile joint, as reflected by the improvement in the post-op Knee Clinical Score and Knee Functional Score.

Keywords: Total Knee Arthroplasty, Primary Osteoarthritis, Knee Functional Scores

Introduction
The embryological development of knee joint is from the leg bud at 28 days with the formation of femur, tibia and fibula by 37 days. The knee joint arises from blastemal cells with the formation of patella, cruciate ligaments and menisci by 45 days. The knee joint is the largest and most complicated joint in the body. Basically, it consists of two condylar joints between the medial and lateral condyles of the femur and the corresponding condyles of the tibia, and a gliding joint, between the patella and the patellar surface of the femur. Note that the fibula is not directly involved in the joint.
Stability of the knee is a complex issue and involves ligaments that behave differently on the medial and lateral side. Correct positioning of the components and adequate soft-tissue balancing are critical steps in successful total knee arthroplasty [1]. A total knee prosthesis that is implanted —too tightly may cause limited range of motion and compromise patient satisfaction. A total knee replacement that is implanted-too loosely will be unstable [2]. Medial-lateral instability is the most common type of instability and may result from incompetent collateral ligaments, incomplete correction of a preoperative deformity, or incorrect bone cute. Separate studies have identified instability as a leading cause of early clinical failure of a primary total knee replacement, resulting in revision within three to five years [3].
Computer-assisted surgery is a new approach to total knee replacement where the patient's specific anatomy is simulated and displayed on a computer screen. The computer gives the surgeon real time information which assists with bone cuts and alignment of the parts.
The patient's anatomical information is entered into the computer through a process called "registration." The computer is able to reconstruct a three-dimensional image of the patient's knee. It is able to calculate the best position to place the components for accurate alignment.

It also helps the surgeon balance the soft tissues for better function and stability [4].

With the advent of computer assisted instruments minimally invasive surgeries came to light. The length of the skin incision, while the most visible, is not an important aspect of minimally invasive total knee replacement. Exactly what is done to the capsule surrounding the knee joint and the quadriceps tendon just above the knee cap affects recovery more than any other issue.

The skin incisions are much smaller than before, but what is done underneath is the real factor. Traditionally when replacing a knee, the knee cap would be flipped over and the knee fully bent to bring the ends of the femur and tibia into view. This requires a longer incision in the knee joint capsule and quadriceps tendon above the knee cap. With more attention to the subtleties of leg position, the optimal placement of surgical instruments, and improving the design and reducing the size of surgical instruments, all of the goals of total knee replacement can be achieved without making the incision up so high and without flipping the knee cap over.

The use of computer-assistance during surgery has great advantages because many of the traditional, space occupying instruments that are used with traditional surgery are completely eliminated_ Instead, a narrow digitizing probe can be slid into critical areas to measure important factors such as joint surface position and rotation. The combination of minimally-invasive techniques with computer assisted techniques is far more powerful than either one alone [5].

One of the most significant complications after TKA is the development of Deep Vein Thrombosis (DVT), possibly life-threatening. Factors that have been correlated with an increased risk of DVT include age older than 40 years, estrogen use, stroke, nephrotic syndrome, cancer, prolonged immobility, previous thromboembolism, congestive heart failure, indwelling femoral vein catheter, inflammatory bowel disease, obesity, varicose veins, smoking, hypertension, diabetes mellitus, and myocardial infarction. The overall prevalence of DVT after TKA without any form of mechanical or pharmaceutical prophylaxis has been reported to range from 40% to 84%.

Clinical examination is unreliable in detecting DVT because most clots occur without signs or symptoms. Venography is the classic radiographic method of detection of DVT and is still considered the gold standard, especially for research purposes. Venography carries the risk of anaphylactic reaction to the contrast media and a small risk of inducing DVT. Duplex ultrasound has been reported as an alternative method of diagnosis of DVT after total joint arthroplasty. Woolson and Pottorff and Tremaine *et al*. documented sensitivities of 67% to 86% with duplex ultrasound using venography for comparison [6, 7].

Many methods of DVT prophylaxis are available, including mechanical devices such as compression stockings or foot pumps and pharmaceutical agents such as low dose warfarin, low-molecular-weight heparin, fondaparinux (a pentasaccharide factor Xa inhibitor), and aspirin. Prophylaxis with aspirin alone has not been proved to be effective against DVT after TKA, according to Haas *et al*., Lotke *et al*., and Westrich and Sculco, with total DVT rates ranging from 59% to 73% 76' 77' 78' 79. Low-molecular-weight heparin and fondaparinux have been shown to be effective in DVT prophylaxis after TKA. The benefits of these medications include a standard dose regimen and the absence of routine laboratory monitoring. The disadvantages include greater medication cost, subcutaneous administration and increased incidence of bleeding. Low-molecular-weight heparin with epidural or spinal anesthesia must be used with extreme caution because epidural hematomas with disastrous neurological complications have been reported. The time of utmost risk apparently occurs on postoperative day 3 when the indwelling catheter is removed from a patient being treated with low-molecular-weight heparin for DVT prophylaxis.

Methodology

This was a hospital-based prospective observational study which was done to analyze the functional outcome of Cemented Total Knee Arthroplasty for primary osteoarthritis. 30 patients who consecutively consented and underwent Posterior Cruciate Sacrificing Cemented Total Knee Arthroplasty were assessed clinically and functionally using Knee Society scores. The follow-up period was at 3 months, 6 months.

Inclusion criteria

All patients above the age of 45 years warranting TKR as a treatment modality for unilateral or bilateral knee joints for osteoarthritis of the knee.

Exclusion criteria

1. Acute infective conditions, local or systemic.
2. Patients with comorbid conditions unfit for surgery.
3. Patients with joint or other abnormalities deterring mobilization.
4. Neuropathic arthritis

Results

Table 1: Age Distribution

Age Group	Frequency	Percent
51-55	7	21%
56-60	8	24%
61-65	8	24%
66-70	5	15%
71-75	2	6%
Total	30	100%

The majority of the patients were from the age group of 61-65 years which accounts for 35% of patients in our study. The youngest patient was 51 years of age and the oldest patient was 74 years. The mean age was 63.45 years.

Table 2: Gender Distribution

	Frequency	Percentage
Left	12	40%
Right	18	60%
Total	30	100%

There was a predominance of right side accounting for 60% of the patients.

Table 3: Knee Clinical Score

	N	Men	Median	Mode	Standard Deviation	Minimum	Maximum
Pre-OP	30	26.75	27.50	36	8.51	15	39
Post-Op	30	94.1	97.00	98	6.56	80	99

The mean Pre-op Knee Clinical Score was 26.75 in this study which improved to a mean Post-Op Score of 94.1.

Table 4: Grading of Knee Clinical.

	Frequency	Percentage
Excellent	24	80%
Good	06	20%
Poor	00	00%
Total	30	100%

According to the Knee Society Clinical Scoring System of the 20 Patients assessed in this study 24 patients (80%) had excellent results and 06 patients (20%) had good results and none had poor results.

Table 5: Comparison Between Pre-OP and Post-Op Knee Clinical and functional scores.

	Paired difference		P-Value
	Mean	Standard Deviation	
Pre-Op KCS – Post Op KCS	67.35	65.96	<0.001
Pre-Op KCS – Post Op KFS	45.40	8.896	<0.001

The difference between the means's of pre-op KCS and post-op KCS was 67.35 (64.56 to 70.14, 95% CI). The P Value was significant (<0.001) when the pre-op and post-op Knee Clinical Scores were compared. The difference between the mean's of pre - op KFS and post - op KFS was 45.40 (41.24 to 49.56, 95% C1). The P value was significant (<0.001) when the pre - op and post-op Knee Functional Scores were compared.

Discussion

Total Knee Arthroplasty is generally an effective procedure and is associated with substantial functional improvement. Elderly patients who were having difficulty mobilizing because of degenerative arthritis found good relief after Total Knee Arthroplasty. There was a substantial relief of joint pain, increased mobility, correction of deformity and an improvement in the quality of life of the patients following Posterior Cruciate Sacrificing cemented Total Knee Arthroplasty. With the varied amount of implant designs available the posterior cruciate substituting design was found to be effective [8].

C. Buz Swanik found that following total knee arthroplasty, patients were able to reproduce joint position and improve mobility significantly. These changes may result from the retensioned capsulo-ligamentous structures and reduced pain and inflammation. The balance index also improved significantly from the preoperative to the postoperative evaluation. The group treated with the posterior stabilized prosthesis more accurately reproduced joint position when the knee was extended from a flexed position. Retention of the posterior cruciate ligament does not appear to significantly improve proprioception and balance compared with those functions in patients with a posterior stabilized total knee design [9].

Gait analysis by Andriacchi and Galante, Kelman *et al*., and others found that individuals with PCL-retaining prostheses have a more symmetrical gait, especially during stair climbing, than do individuals with either PCL-sacrificing/PCLsubstituting designs. They showed decreased knee flexion during stair climbing and a tendency to lean forward in a quadriceps-sparing posture in patients with PCL-sacrificing/PCL-substituting designs. They postulated that these observations may indicate inadequate rollback of these designs or possibly the loss of a proprioceptive role of the PCL. These observations have been cited as reasons to retain the PCL [10].

Gait analysis by Wilson *et al*. contradicts the conclusions of these earlier studies, however, after comparing PCL-substituting/sacrificing knees with normal controls. These earlier observations are refuted further by *in vivo* studies by Stiehl *et al*.; Victor, Banks, and Bellemans and Dennis *et al*., who used fluoroscopy during single-stance deep knee bends to show a paradoxical forward translation of the femorotibial contact point during weight bearing flexion in some PCL-retaining knees; PCL-substituting/sacrificing knees studied showed more uniform femoral rollback [11, 12].

Whether the PCL is salvaged or sacrificed at TKR has been much debated. Posterior glide and roll of the femorotibial contact region with flexion is influenced by the PCL. Isolated removal of the PCL increases the flexion gap. While it may be attractive in gaining surgical access and subsequent flexion, PCL sacrifice encourages posterior tibial subluxation. A tibial post and femoral cam, or a dished polyethylene insert with raised anterior lip, may resurrect both stability and femorotibial rollback. Evidence suggests that using PCL-substituting/sacrificing designs increases post-operative knee flexion. This could perhaps be because of more normal kinematics. Fluoroscopic studies demonstrate increased femoral rollback using the cam-post articulation as compared with some PCL-retaining systems [13].

Conclusion

With the use of cemented Posterior Cruciate Sacrificing Design, at two year follow up an average pre-op Knee Clinical Score of 26.75 improved to an average postop Knee Clinical Score of 94.1 and an average pre-op Knee Functional Score of 39.35 improved to an average post-op Knee Functional Score of 84.75.

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