

# Early Results of Total Knee Replacements: "A Clinical and Radiological Evaluation"

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## Summary

From March 1986 to June 1992, 100 primary total knee arthroplasties were done in 69 patients. The demographic data and complications were analysed in these 69 patients. The first 50 knees with a minimal follow-up of one year (range 1 - 6 years) were analysed in more detail according to the International Knee Society Rating System. Detailed radiological evaluation was also carried out to assess positioning of the components. There were 79 knees with osteoarthritis, 20 knees with rheumatoid arthritis and one with Systemic Lupus Erythomatosus (SLE). The knee score was poor in all knees pre-operatively. Post-operatively 78% had good to excellent score and the other 22% had fair knee score. However the functional score remained poor in 50% of the knees. Ideal tibio-femoral alignment was obtained in 68% of the knees. Twenty four percent of the knees had 0-4° of varus and eight percent had 10-12° valgus. Complication rate was low with 1% of infection (one knee). Overall early results were satisfactory.

**Key words:** Arthroplasty, Knee.

## Introduction

Since the total condylar prosthesis was first implanted in 1974, several designs of prostheses have become available in the market. The long term results of total condylar prosthesis were published by Insall *et al*<sup>1</sup> in 1985 which showed 87.5% satisfactorily functioning prostheses at 10 years. This encouraged us to start total knee joint replacement at the University Hospital in March 1986. Although initially there was a reluctance on the part of our patients to undergo a new procedure, however, now this procedure is quite readily accepted by our patients. The aim of this study was to evaluate the early results of total knee arthroplasty in Malaysian patients at the University Hospital, Kuala Lumpur.

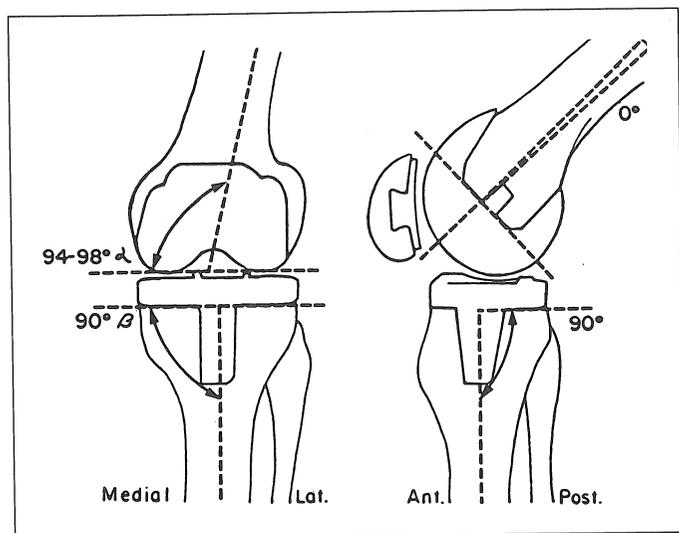
## Materials and Methods

From March 1986 to June 1992 a total of 100 primary total knee arthroplasties were done on patients by the senior author. There were 51 females and 16 males with an age range of 21 to 85 years (average 66.5 years). The preoperative diagnosis was osteoarthritis in 54 patients (79 knees) and rheumatoid arthritis in 12 patients (20 knees) and SLE in one patient (one knee).

Three patients were treated with one stage bilateral procedure. The patella was resurfaced in all but 10 knees. The average weight of the rheumatoid patients was 56.0 kg (range 35 to 65 kg) and the average weight of the patient with osteoarthritis was 66.5 kg (range 49 to 80 kg). The complications were analysed in these 100 patients. The first 50 patients who had a minimum follow-up of one year and were on regular follow-up were analysed in more detail according to the International Knee Society rating system<sup>2</sup>. According to this system, rating was done separately for the knee and for function. A stringent point allocation was used. Scores of 90 to 100 points were designated as excellent results, 80 to 89 points a good result, 70 to 79 points as fair result and below 70 points was deemed as poor result.

The orthopaedic theatre for these procedures was a general orthopaedic room with vertical airflow. Neither ultraviolet radiation nor laminar airflow ventilation was used in this series but standard prophylaxis with antibiotics was routine. No prophylaxis against thromboembolic disease was used. Post-operative range of motion and quadriceps strengthening exercises were begun on the day following surgery. Ambulation was begun as soon as patients could do a straight leg raise without a significant quadriceps lag. Patients were discharged as soon as they had more than 90° knee flexion and were able to ambulate and climb steps.

Post-operative radiographs in these 50 knees at three months or more follow up were also analysed for measurement of the position of components (Fig 1)<sup>3</sup>.



**Fig 1:** Outline of an anteroposterior and a lateral radiograph, depicting the measurements of the positions of the components. (Adapted from: Ewald, F.C.; Jacobs, M.A.; Miegel, R.E.; Walker, P.S.; Poss Robert; and Sledge, C.B.: Kinematic Total Knee Replacement. *J. Bone and Joint Surg.*, 66-A: 1035, Sept. 1984)

The average preoperative range of movement was 100 (range from 60° to 125°). Forty-two of the fifty knees (84%) had a flexion contracture. In 38 knees (76%) the flexion contracture was 15° or more.

Forty eight of the 50 knees (96%) had a pre-operative varus deformity. The other two knees had a valgus deformity of more than 20°.

The preoperative knee score (Table I) was poor in all cases.

**Table I**  
**Pre-op and post-op knee score according to knee society rating system**  
 (Number of knees)

	*Post-op score				Total pre-op score
	Poor	Fair	Good	Excellent	
<b>Pre-op score+</b>					
Poor	0	11	16	23	50
Fair	0	0	0	0	0
Good	0	0	0	0	0
Excellent	0	0	0	0	0
<b>Total post-op score</b>	0	11	16	23	50

+ Average pre-op score is 20

\* Average post-op score is 88

The preoperative functional score (Table II) was poor in 48 knees (96%) and fair in two knees (4%).

## Results

The post-operative average range of movement was 108° (range 60° to 120°). All patients except for three had more than 90° of knee flexion post-operatively.

In all but 10 knees the flexion contracture was corrected, eight knees had a residual contracture of 5° and two knees had a post-operative contracture of 15°.

The knee score at the last follow-up (Table I) was excellent in 23 knees, good in 16 knees and fair in 11 knees.

The functional score (Table II) on the other hand was not as good. In five knees the functional score was good and 20 knees had a fair functional score. In 25 knees the functional score remained poor.

## Statistical Analysis

According to the International Knee Society Scoring System the patients are categorized into three.

- Category A : Unilateral or bilateral  
(opposite knee successfully replaced)
- Category B : Unilateral (other knee symptomatic)
- Category C : Multiple arthritis or medical infirmity

When the pre-operative and postoperative knee and function scores were compared in all categories of patients, there was a statistically significant ( $P < 0.0050$ ) improvement in both the scores post-operatively (Table III).

**Table II**  
**Pre and post-operative functional score according to knee society rating system**  
 (Number of knees)

	*Post-op score				Total pre-op score
	Poor	Fair	Good	Excellent	
<b>Pre-op score+</b>					
Poor	18	10	7	13	48
Fair	0	2	0	0	2
Good	0	0	0	0	0
Excellent	0	0	0	0	0
<b>Total post-op score</b>	18	12	7	13	50

+ Average pre-op score is 20

\* Average pre-op score is 70

**Table III**  
**Chi-square test ( $X^2$ ) and P-values for**  
**pre and post-operative knee and function score**

	Pre-op vs Post-op		
	$X^2$	p	
Knee Score	88.67	< 0.0050	sig.
Function Score	41.67	< 0.0050	sig.

**Table IV**  
**Chi-square test (after Yate's correction) and P-values**  
**for knee score for categories A, B, and C.**

Cat.	Knee score		
	$X^2$	p	
A vs B	1.2566	> 0.85	N.S.
A vs C	12.2579	< 0.010	Sig.
B vs C	15.5279	< 0.0050	Sig.

The Chi-square tests (after Yate's correction) were performed for knee score (Table IV) and function score (Table V) to compare categories A, B & C.

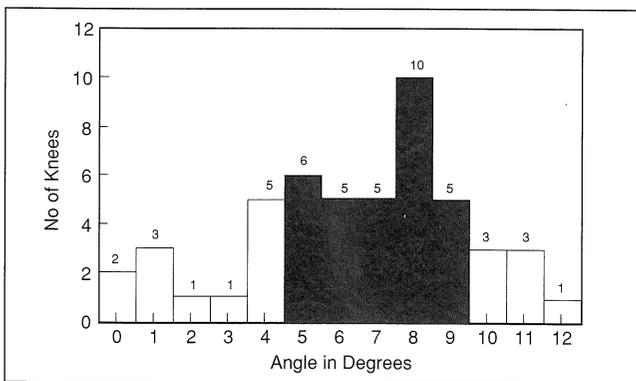
**Table V**  
**Chi-square test and P-values (after Yate's correction)**  
**for function score for categories A, B, and C.**

Function score Chi-square test (after Yate's correction)			
Cat.	X <sup>2</sup>	p	
A vs B	0.4892	> 0.09	N.S.
A vs C	12.2191	< 0.005	Sig.
B vs C	11.7509	< 0.010	Sig.

There was no statistical significant difference in the knee and function score between patients in category A and B (P = 0.85 and P > 0.09 respectively). However the knee and function score was significantly better in category A and B when compared with category C.

**Radiological Evaluation**

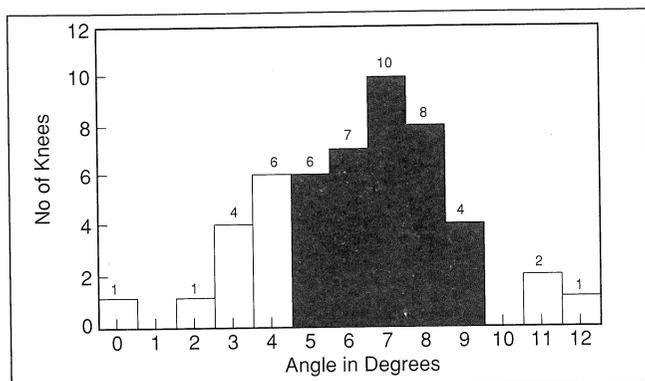
Radiological evaluation of the post-operative x-rays at 3/12 or more showed ideal tibio-femoral alignment of 5° to 9° in 34 knees (Fig 2). Twelve knees had 0° to 4° angulation (varus) and four knees had a 10°-12° valgus alignment. Measurement of the Femoral angle in the anterior posterior view (Fig. 3) showed an ideal angle of between 95° to 99° (5°-9° valgus) in 35 knees, three knees had angles between 100° and 102° (10° to 12° valgus) and 12 knees had an angle of 90° to 94° (0°-4° valgus).



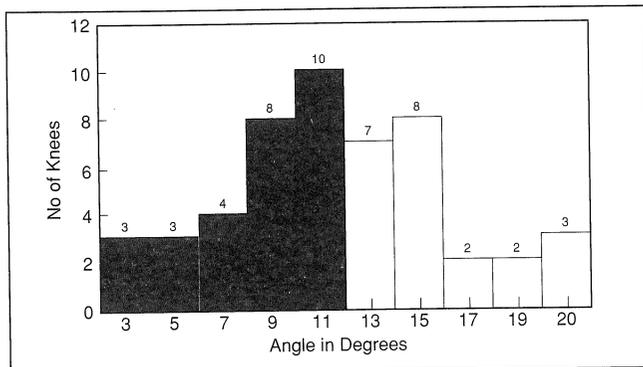
**Fig 2: Post-operative tibio-femoral alignment (5°-9° is ideal)**

Femoral flexion angle (Fig. 4) was within the ideal range of 0°-10° in 28 knees and in 22 knees there was an increase in flexion angle. It was from 11° to 15° in 15 knees and 15° to 20° in seven knees.

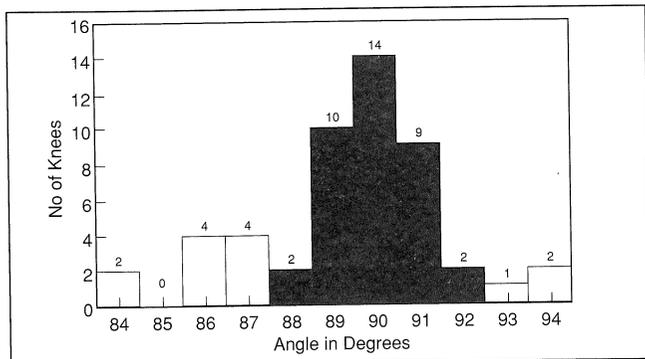
The tibial angle in the anterior posterior view (Fig. 5) was within the ideal range of 88° to 92° in 37 knees and between 93° to 94° in three knees. There was medial tilt of the tibial component in 10 knees with an angle of between 84° to 87°. In the lateral view (Fig. 6) the tibial components had ideal angles of between 88° to 92° in 32 knees. There was an anterior tilt in 14 knees with angles of between 93° to 98° and a posterior tilt with angles of between 84° to 89° in 4 knees.



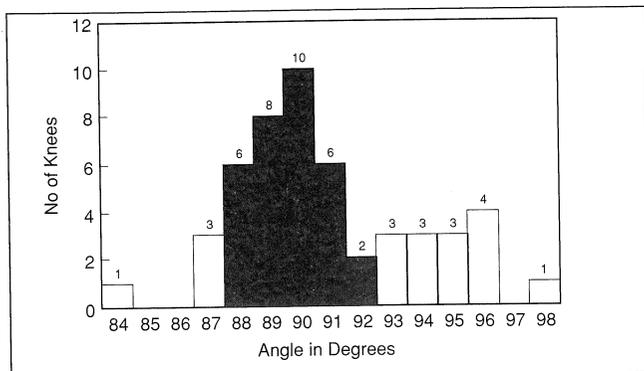
**Fig 3:** Post-operative prosthetic femoral angle in anterior posterior view ( $5^{\circ}$ - $9^{\circ}$  is ideal)



**Fig 4:** Post-operative femoral flexion angle ( $0^{\circ}$ - $10^{\circ}$  is ideal)



**Fig 5:** Post-operative prosthetic tibial angle in anterior posterior view



**Fig 6:** Post-operative prosthetic tibial angle in the lateral view

### Complications (100 Knees)

Of the 100 knees, one patient with rheumatoid arthritis who had ankylosis of both hips and knees in 90° and was wheelchair bound had replacement of all four joints. One of the knees had deep infection and loosening of prosthesis at six months post operatively. The prosthesis was removed and arthrodesis of the knee carried out. Revision was not possible because of excessive bone resection at primary surgery because of ankylosis in 90° of flexion.

One patient had wound breakdown due the fact that the incision for arthroplasty ran at an acute angle to a previous oblique synovectomy scar. This wound was superficial and healed after two months of regularly dressing without further surgery.

There was patellar loosening in one knee and was successfully revised.

One patient had a supracondylar fracture of the femur which was treated by conservative means and had satisfactory range of motion of 0 to 100° subsequently.

One patient with rheumatoid arthritis had a tear of the medial collateral ligament intra-operatively due to use of spreader for assessment of ligament balance. This could not be repaired primarily and patient was treated in a post-operative brace with satisfactory healing.

Of the 100 knees, in 10 knees there was anterior knee pain but no dislocation of the patella. This knee pain occurred on getting up from sitting position when knee was being extended at about 20° or 30° of knee flexion. There was no pain on ambulation in these patients. There was no nerve palsy in any of the patients.

One patient age 85 years had a cerebrovascular accident on the third post-operative day. He developed hemiplegia and was unable to ambulate.

### Discussion

Although up to 11 years follow-up of Total Knee Replacement with 92.8% good to excellent results have been published in literature<sup>4</sup>, we felt that an early evaluation of our results would be appropriate to see whether we should continue or improve our technique and/or operating conditions.

The majority of our patients undergoing Total Knee Replacement were females (76%) and the pre-operative diagnosis was osteoarthritis in 81% of these patients. We are unable to conclude whether osteoarthritis is more common or it is more severe in the female population.

The pre-operative knee score was poor in all cases with a score of less than 50 in 96% of the knees, the postoperative knee score was good to excellent in 78% of the knees and fair in 22% of the knees. On the other hand the functional score was less than 50 in 90% of the knees pre-operatively but the postoperative functional score remained poor in 50% of the knees. The other 50% had good to fair results. We used a more stringent criteria for grading of our score into excellent, good, fair and poor compared to other studies. We believe that there are two reasons for this lack of significant improvement in functional score. One is the group of patients with rheumatoid arthritis in whom the knee score improves but functional score remains poor due to multiple joint disease. The other are patients with osteoarthritis in whom the knee score improves but the functional score remains poor due to cultural reasons. These are female patients who have become accustomed to a sedentary way of life confined to their homes, and refuse to walk long distance or attempt to climb stairs.

Furthermore a large majority do not have stairs in their houses. When walking they prefer to use a stick which gives them more confidence. These factors reduce their functional scoring as points for functional score are given for walking distance and stair climbing. The use of walking stick gives a minus point. The main reason many of these patients subject themselves to surgery is for pain relief rather than for improving their lifestyle. This has to do with our Malaysian lifestyle because many of the elderly Malaysian women who are healthy lead a life confined to their house.

Therefore for functional scoring in our patients, the scoring system of the International Knee Society is probably not appropriate. What our patients want is ability to squat rather than walk long distance or climb stairs. Squatting is an essential function in our society for prayers and daily house chores. Statistical analysis showed a statistically significant improvement in knee and function scores post-operative as would be expected. The function score was significantly poorer in patients in category C (multiple arthritis or medical infirmity) as compared to category B and A and this would be expected. However what we were not able to explain was the significantly poorer knee score in category C patients compared to category A and B. It is possible that the patients with multiple arthritis or medical infirmity were not able to perform post-operative physiotherapy satisfactorily. In our series the tibial femoral alignment was ideal in only 68% of the knees. 24% had 0 to 4° of varus alignment and 8% had 0 to 3° of valgus alignment. Although the deviation into varus was only 0 to 4° in 24% of the patients, this is of concern as varus alignment may predispose to loosening in the long term. The position of femoral component in the medio-lateral direction was ideal in 70% of the knees, the tibial component in the medio-lateral direction was ideal in 74% of the knee. The anterior posterior position of the tibial component was ideal in 64% of the knee. The femoral position in anterior-posterior direction (femoral flexion angle) was ideal in only 56% of the knee.

The common error with positioning of tibial component was a medial tilt and an anterior tilt. With the femoral component the common error was a posterior tilt and a medial tilt.

The most likely cause of the medial tilt of the tibial component was failure to centralise the tibial alignment rod at the centre of the ankle joint. Anterior tilt probably must be due to inadequate soft tissue release posteriorly and forcing the joint into full extension after the implant has been inserted causing the prosthesis to sink anteriorly into soft bone of the tibia. This is most likely to occur in rheumatoid patients with osteoporotic bone.

The medial tilt of the femoral component is likely due to a failure of introducing the intramedullary femoral alignment rod far enough proximally to the isthmus of the medullary canal especially in patients who have bone loss in the medial femoral condyle. This can also occur in patients who have a previous Total Hip Replacement and the alignment rod cannot be introduced far enough proximally. The use of external alignment rod in this circumstance would prevent this.

The most common error in this series was posterior tilt of the femoral component. This often occurs when the femoral component is hammered in place; because of more dense bone on the anterior aspect (at junction of the femoral condyle and shaft of femur) and soft bone on the posterior aspect, the femoral component tends to tilt backward. Hence to prevent the tilt a perfect anterior cut using a good quality saw blade each time is of paramount importance.

The overall short term results were satisfactory. There was no difference in the short term results of patients who had the patella resurfaced and those in whom the patella was not resurfaced.

Infection rate was only 1% with one deep infection (in a patient with rheumatoid arthritis who had

both hips. Both knees replaced) although we used a ordinary operating theatre with vertical air flow.

A common complication was patello femoral pain in 10% of the patients. This complication along with a supracondylar fracture and the tear of the medial collateral occurred in the earlier group of patients. With more experience these technical complications have become more infrequent.

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