Assessment of functional range of movement after total knee arthroplasty for osteoarthritis

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Summery

Background: Total Knee Arthroplasty (T.K.A) is a standard treatment of knee osteoarthritis, to relieve pain and improve range of movement. (R.O.M.)

Aim of the study: Is to assess the functional .(R.O.M.) before and after sugery.
Patients and methods: 59 (T.K.A) of 53 patients performed at Nursing Home Hospital, Teaching Medical City - Baghdad, the implant used was cemented NexGen PS-Flex (Zimmer) design. Patient devided in to three groups according to pre-operative range of flexion. group1 ($>110^0$). group2 (90^0-110^0), group 3 (<90). with pre-operative flexion contracture $\leq 15^0$. and tibiofemoral angle $\leq 15^0$.

Results: there was significant increase in the range of flexion and extension in group 3. while there was no deference in the range before and after operation in group 2. while in group1 there was loss in flexion and gain in extension at one year follow- up after surgery .

Conclusion: the pre-operative R.O.M. of arthritic knee predicted the pos-operative R.O.M.
Key words: total knee arthroplasty. Osteoarthritis. Range of movement .

Introduction

The primary indication for Total Knee Arthroplasty (T.K.A) is to relieve pain caused by osteoarthritis and to improve the range of movement which has been reduced significantly due to the disease, Sufficient knee joint flexion is required for safely complete activities of daily living, which has been estimated to be 54^o-79^o for level walking, 90^o-97^o for descending stairs, 90^o-104^o for climbing stairs, and 93^o-105^o for rising from a chair[(1)(2)]. Deep flexion is specially important for Islamic and middle eastern populations as many of their cultural and religious activities demand full flexion, i.e 155^o - 160^o [(3)]. For European $110^{o,}$ -115^o of flexion may be considered adequate for the life style of seniors. Indeed patients with lowest level of function tend to have the T.K.A with the lowest flexion and vice versa[(3)]. The range of movement (R.O.M) of the knee has not been described in terms of whether it constitute knee flexion or the overall R.O.M of the knee (flexion and extension) i.e flexion arc. Clinical goniometry when if held constant has good to excellent reproducibility within and between raters[(4)]. How (visual or radiographic goniometry), or who measures is an issue partially explains the heterogenicity of the reported ranges among studies,

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Our primary objective in this retrospective study is to compare the range of movement of the knee (both flexion and extension) before the operation and one year after, a range which enables patients to perform their essential daily living activities.

Patients and methods

From September 2008 to November 2010, 86 T.K.A (44 Right, 42 Left) for various knee pathologies were performed at Nursing home hospital, teaching Medical-City in Baghdad by one team (one specialist surgeon and two trainees), the prosthesis used was NexGen PS-Flex (Zimmer) design (Cemented). Twenty seven T.K.A were excluded form this study of which patients with Rheumatoid arthritis (n=7). post-traumatic arthritis (n=1). knees with previous osteotomy (n=2) synovectomy (n=1) and patients with severe complications (n=3) (infection n=2, intra-operative patellar rupture (n=1), and revision for aseptic loosening (n=2) within one year after surgery, and patients who had their records incomplete or could not retrieved (n = 11).

Fifty nine T.K.A for 53 patients were subjected for analysis in this study (six patients with bilateral knees replacement), (32) females, and (21) males with mean age 64 year (55-76 year). Patients body weight range of from 76 - 103 Kg with mean 86 Kg. Mean body height 162cm (140-182)cm, Similar surgical technique were used, no patellar resurfacing, nor correction of collateral ligaments, or of the extensor mechanism. The follow up period was one year postoperatively. The R.O.M of the knees was measured with two long-arm goniometer performed by the surgical team themselves (the specialist (OS) trainees (T) physiotherapist (P.T), the mean figures were taken from those raters, measurements taken at visits, three, and six months intervals and finally one year after operation.

The knees were divided into three groups according to the pre-operative flexion range, Table (2) Group (1) with flexion > 110^o, group (2) (90^o-110^o). Group (3) <90^o. coronal deformity in all patients groups ≤ 15^o,

Table 1: Details of the 53 patients, regarding age, height, and weight

Parameter	Mean	Range	SD
Age / y	64 y	55 – 76 y	5.4
Height / Cm	162/cm	140 – 182	6.8
Weight / Kg	86/kg	79 – 103	11.2

Table 2 : Pre-operative R.O.M of 59 knees and the flexion contracture

group	gender		Total No.	Range of flexion	Flexion contracture	Tibio-femoral angle Varus or valgus
	No. male	No. female				
Group (1)	6	10	16	>110^0+12^0	<10 (10-3^0)	
Group (2)	10	15	25	> 91^0 - 110^0		≤ 15^0
Group (3)	5	7	12	< 90^0 - 7^0	≥ 10^0 + 5^0	

The patients were subjected to programmed physiotherapy protocol from the 2nd post-operative day which include a quadriceps exercises, bed sitting, standing and walking for 2-3 steps on the third post-operative day, walking with aids form 7th to10th day after surgery. Average hospital stay was 5 – 7 days.

Non-loading goniometry assessments performed with the patients laying supine, the active and passive flexion ranges were recorded.

Table 3 Comparison of pre- and post-operative ranges of flexion

The groups	**Mean pre-op. flexion**		**Mean post-op. flexion female male**		**Mean change**
	female	**male**			
Group (1) $> 110^0$	$117^0 \pm 7^0$	$114^0 \pm 3^0$	$107^0 \pm 3^0$	$102^0 \pm 2^0$	$- 11.5^0$ P < 0.001
Group (2) $> 90^0$ (90^0-110^0)	$106^0 \pm 3^0$	$106^0 \pm 3^0$	$106^0 \pm 4^0$	$106^0 \pm 2^0$	$+ 3^0$ (P.004)
Group (3) < 90	$87^0 \pm 2^0$		$97^0 \pm 4^0$	$95^0 \pm 3^0$	$+ 12.3^0$ (P.001)
Mean rang of flexion in all groups	112^0	108^0	106^0	103^0	
Flexion contraction	3^0 - 15^0		2^0 - 5^0		$10^0 \pm 1^0$ P>0.05

Results

Table 3 indicate the changes in all the parameters ($p<0.001$) after operation, although flexion ranges as well as flexion arc decreased on hospital discharge, the maximal improvement in each group was clear and final at the end of the first post op. year.

In group (2) (90^0-110^0) no significant changes before and after operation was found. In group 3 ($<9^0$) there was gain in flexion and extension, While in group (1) ($>110^0$) there was loss in the R.O.M , i.e flexion arc reduction .

The mean post-operative flexion in females was significantly more than that in males in all groups, 106^0 and 103^0 respectively, Pre-op. flexion in females was greater than that in males, ($p = 0.032$).)$112^0 – 108^0$ respectively .

Pre-operative flexion ranges of patients with tibio-femoral angle $\leq 15^0$ varus or valgus were not significantly different from the ranges postoperatively. Flexion contracture reduced in group (1) by 8 ± 2 and $2 - 5^0$ in group (2) and 4.5^0 in group (3) at one year after operation.

Discussion

The primary objective of T.K.A for knee osteoarthritis is pain free, stable joint with good R.O.M capable to perform the essential daily living, social and religious activities, with recent prosthesis designs those two goals had been achieved, The mean post-op. flexion of the patients' knees in this assessment was 103^0, with loss of $4\text{-}6^0$ flexion but again of 5^0 of flexion arc in group I, and a gain up to 12^0 in group III after surgery due to increase in extension by $5^0\text{-}8^0$ in group II, and $3^0\text{-}7^0$ in group (3) respectively, these results were comparable to others studies[5]. A mean post op. range of 103^0 flexion is insufficient for some activities especially for eastern people and the Islamic population in particular in the form of prolong kneeling [6] or squatting during toilet or knee position for the purpose of praying which require a knee flexion of $155^0\text{-}160^0$ [7] a range is far from obtaining from most of contemporary T.K.A which rarely exceed 135^0 at most[8]. Therefore the life style of many patients has to be compromised (8)(9).

The pre-operative flexion is considered the most critical determinant of post operative flexion as it is the case in group (3) when severe flexion of long standing period result into bone and soft tissues changes which cannot corrected by T.K.A[10][11], Shurmann et al [9] and Tew (3), Sholonok[10] arrived to same results of ours, in knees with satisfactory pre-operative conditions as those patients of group (1) ($>110^0$) their flexion improved to less extent (8 ± 3) compared to 12^0 - 15^0 in group (3).

In each post-operative review of our patients up to one year after surgery we found increase in flexion and decrease in flexion contracture down to 2^0 - 5^0 which is the final improvement this is supported by other studies which illustrate that there will be no further improvement even 4 year post op. (Rorabeck)[11] and up to 5 years (Insall)[4] and at 10 years (Harvey et al)[12], although others described worsen results with the range of flexion at one year worse than before the operation (Ritter)[13].

The minimal range of flexion on discharge from the hospital in our patients was 75^0.

The post-operative intensive physiotherapy had most influential factors for good post-operative flexion of our patients in this study, a contrary to other authors, Nielson et al[14] who found no help from the use of continuous passive motion postoperatively.

Body weight (mean 68 kg) had no influence on the functional results after T.K.A, since the patients in this study had the average population weight and no gross overweight.. a result supported by Yoshino et al [8].

Twelve T.K.A on 6 patients with Bilateral flexions included in this analysis showed no difference in their R.O.M from patients with monoarticular arthroplasty, a conclusion agree with Sheurmann and others [9] [14].

In our study the post operative improvement in the R.O.M in female and elderly was more than in male and younger patients ($5^0 \pm 1^0$) and ($3^0 \pm 1^0$) respectively, this outcome consistent with that of Ritte et al (13) and this finding might be related to laxer soft tissue and less scarring in elderly and female than in male and younger patients [15].

However cane and tripot crutches usage was more frequent and for longer period after surgery by females than by males.

Conclusion

Patients with stiffest knees had the greatest improvement in movement which continue to gain in flexion and loss of flexion contracture up to one year after T.K.A.

The improvement in R.O.M after knee replacement is sufficient for most of the essential daily living activities for the eastern and islamic people.

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