GAVIN PUBLISHERS

OPEN ACCESS

Journal of Orthopedic Research and Therapy

El-Sadek M and Abd-Elhady E J Orthop Res Ther 5: 1179.

DOI: 10.29011/2575-8241.001179

Research Article

Total Knee Arthroplasty in Patients with Fixed Flexion Contracture

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Citation: El-Sadek M, Abd-Elhady E (2020) Total Knee Arthroplasty in Patients with Fixed Flexion Contracture. J Orthop Res Ther 5: 1179. DOI: 10.29011/2575-8241.001179

Received Date: 05 November, 2020; **Accepted Date:** 27 November, 2020; **Published Date:** 02 December, 2020

Abstract

Background: soft tissues balancing and flexion knees deformity were difficulties' in patients with advanced knee arthritis managed by Total Knee Arthroplasty (TKA).

Objectives: the purpose of our study was the evaluation of clinical and radiological results of patients with advanced primary Osteoarthritis knee with fixed flexion deformity.

Patient & Method: prospective study of twenty five knees (twenty one patients unilateral and two patients bilateral) with primary Advanced OA with moderate to severe fixed flexion deformity with varus knee deformity in ten knees (varus range 15-25o). All patients were managed by primary TKA with appropriate soft tissues balancing from June, 2010 to July, 2018 in our university hospital. There were 9 male and 12 female with bilateral knee deformity in two female patients. They were classified into two groups, group I: patients with moderate flexion deformity (MF) with flexion deformity less than 30°, in 14 knees (56%) and group II: patients with severe flexion deformity (SF) with flexion more than 30° in 11 knees (44%). Metal augment in 7 knees long stem tibia in 4 cases 100 mm all was sacrificed PCL with posterior stabilized prosthesis. The patient's clinical and radiological information were evaluated preoperative, Intraoperative and postoperative at a standard period and yearly follow up for two years.

Results: We had no intraoperative complications in this study. Soft tissue release surgery and additional bone cuts were performed in group II. The mean age was 59±5.97 (range 48-71), mean flexion contracture deformity was 34±11.63 (range 20-60), mean preoperative ROM was 65±9.34 (range 45-80) and mean postoperative ROM was 99±932 (range 65-110). There was no difference between group I and group II postoperative ROM (112±10.23 and 115±9.2). In group I mean Knee Society Score (KSS) improved from 34 (0 to 71) to 88 (38 to 100) ($p < 0.001$) and the KSS Functional Score from 43 (0 to 70) to 86 (0 to 100). No knees required manipulations under anaethesia (MUA) and none of the knees had flexion instability. Group II mean Knee Society Score (KSS) improved from 28(0 to 56) to 85 (40 to 100) and the KSS Functional Score from 43 (0 to 70) to 84 (0 to 100). Two knees (8%) required manipulations under anaethesia (MUA) and none of the knees had flexion instability. We had no infection complication and no cases with patellar dislocation or subluxation seen in this study.

Conclusion: Preoperative planning of the knees with severe flexion contracture managed by primary TKA with good soft tissues balancing can be performed successfully.

Keywords: Advanced knee arthritis; Flexion deformity of knee; Total knee arthroplasty

Introduction

Flexion deformity presented in many patients underwent Total Knee Arthroplasty (TKR). The degree of fixed flexion deformity varies from mild, moderate to severe types, most of flexion deformities can be corrected at surgery, part of deformity after induction of anaethesia, and the residual degrees by surgery. Correction of flexion deformity can be obtained by soft tissue release and proper bone cuts during TKR. Full extension must be obtained during and after surgery as residual flexion deformity cannot be tolerated by patients presented as a functional disability [1]. Contractures and shortening of hamstring muscles and ligaments causing knee flexion deformity and added to increasing the energy expenditure during walking, standing alone, and inability for long period standing [2,3]. Osteophytes in intercondylar region of the knee acting as bony block limiting extension. Posterior

osteophytes impinging on the posterior capsule increasing knee flexion deformity and consequently soft tissue contracture. Posterior tibial bone erosion decrease quadriceps strength and extension lag result in in flexion deformity [4]. Flexion deformity were classified by Lombardi, et al [5]. According to its severity into mild Grade I with limited contracture less than 15 degrees ,moderate Grade II with contractures between 15-30 degrees and severe grade more than 30 degrees flexion. Total knee replacement in patients with flexion deformity had to be evaluated clinically and radio logically for grade of flexion, associated coronal plane deformity, range of motion, and lag of extension. Radiologic evaluation including slandered views of the knee for posterior condylar bone erosion and deficiency as it can disturb the rotation of femoral component in posterior referencing guided systems and instrumentations, coronal deformity, posterior and intercondylar osteophytes, augments, allografts can be used in large bone defect; modular prostheses also can be used in such cases [6] (Table 1).

Grade	degree	Common causes
I (Mild to moderate)	Up to 30°	Periarticular muscular spasm Posterior osteophytes Tight posterior soft-tissue structures
II (Severe)	31-60°	Causes of grade I plus Severe contracture of posterior soft-tissue structures Bony defects
III (Very severe)	>60°	Causes of grade I and II plus Severe bony defects (Usually associated with instability and deformity at hip, pelvis and ankle)

Table 1: causes of flexion deformity according to severity of deformity.

The purpose of this study to evaluate the early results after TKR on knees with moderate to severe flexion contractures performed with TKR.

Patients and Methods

This prospective study had conducted on twenty five with 11 male and 12 female (25 knees) with primary OA knee with flexion deformity that underwent primary TKA and soft tissue balancing from June 2010 to July 2018. The mean age was 59.39±5.97 (range 48-71), mean flexion contracture deformity was 34±11.63 (range 20-60), and mean preoperative ROM was 65±9.34 (range 45-80). The mean postoperative ROM 99.2±934 (range 65-110) and the mean disease course was 3.53±0.811 (range 2.4-5.3) years (Table 2). The data included preoperative, intraoperative, and postoperative evaluation at standard intervals and annual follow-up reports. All patients were diagnosed as primary OA arthritis of the knee with varus knee deformity in ten knees (varus range 15-25°). The inclusion criteria were knees had flexion contracture with varus deformity. Exclusion criteria included pathologic conditions of the Rheumatoid Arthritis knee, infection, trauma and tumor. The patients were divided into two groups, Group I Moderate Flexion deformity group (MF) in 12 patients (14 knees) (56%) (With flexion contracture < 30°), 6 male and 6 female and group II Severe Flexion deformity group (SF) 11 patients with 11 knees (44%) three male and nine female (With flexion contracture >30°). In **group I** preoperative mean Knee Society Score (KSS) was 34 (0 to 71) and the KSS Functional Score was 43 (0 to 70). In **Group II** preoperative mean Knee Society Score (KSS) was 28(0 to 56) and the KSS Functional Score was 43 (0 to 70). All patients were encouraged to do physiotherapy in the postoperative period (Table 3).

		NO	Group	Sex	Years	flexion deformity	preoperative	postoperative	disease course
N	Valid	25	25	25	25	25	25	25	25
	Missing	0	0	0	0	0	0	0	0
Mean		13.0000	3.5600	1.6400	59.3600	34.0000	65.4000	99.2000	3.5360
Std. Deviation		7.35980	.50662	.48990	5.97132	11.63687	9.34523	9.31844	.81183
Range		24.00	1.00	1.00	23.00	40.00	35.00	45.00	2.90
Minimum		1.00	3.00	1.00	48.00	20.00	45.00	65.00	2.40
Maximum		25.00	4.00	2.00	71.00	60.00	80.00	110.00	5.30

Table 2: Statistics.

Group		Sex	Years	flexion deformity	preoperative	postoperative	disease course
SF	Mean	1.7273	60.0000	45.0000	62.7273	95.0000	3.9909
	N	11	11	11	11	11	11
	Std. Deviation	.46710	5.69210	8.36660	9.31763	12.04159	.90825
MF	Mean	1.5714	58.8571	25.3571	67.5000	102.5000	3.1786
	N	14	14	14	14	14	14
	Std. Deviation	.51355	6.34710	3.65023	9.14625	4.70270	.51914
Total	Mean	1.6400	59.3600	34.0000	65.4000	99.2000	3.5360
	N	25	25	25	25	25	25
	Std. Deviation	.48990	5.97132	11.63687	9.34523	9.31844	.81183

Table 3: Group statistics.

Preoperative preparation

A knee flexion contracture patient requiring knee reconstruction will be tested for coronal plane deformities, degree of flexion deformity, extensor lag, and preoperative motion range. Standard X-rays should be evaluated to determine bone anatomy disorders, particularly posterior condylar deficiencies, coronal deformities and prominent osteophytes. The posterior condylar deficiency affects the rotation of the femoral component when a posterior reference system or a measured resection technique is used.

Surgical technique

After induction of anesthesia, a pneumatic tourniquet is applied over the limb to be operated and activated immediately before incision. The operating leg is examined again under anesthesia to determine the degree of deformity. Limb is wrapped and packed according to hospital guidelines with betadine or chlorhexidine solution. (Table 4). An incision of the midline skin extending approximately 5 cm proximally to the suprapatellar pouch to a point only of medial to tibial tubercle. Medial parapatellar osteotomy is done with patella eversion, which reveals both lateral and medial femoral condyle. Standard total knee arthroplasty is initiated with "measured resection" in which the bone that is resected is the same dimension as the prosthesis. In **group I:** As in primary uncomplicated arthroplasty, tibial and femoral cuts are carried out in a usual way. The contracture of flexion is due to subsequent recess and osteophytes indenting upon the capsule. Using 3⁄4 inch osteotomies, the osteophytes can be easily visualized and removed after the bony cuts. The loose osteophytes may be extracted with the aid of curette. The subsequent obliterated recess may then be formed with osteotomies. The osteophytes can be extracted from the posterior part of tibia with the help of curette and osteotomies. Further release of posterior recess is accomplished in the event that the extension gap is less than the flexion gap. If the extension gap is greater than the flexion gap, the rear tibia slope may be raised to 8° to balance the knee. Tight flexion distance will cause the femoral portion to roll back improperly and rise off the tibial tray.

In **group II:** In addition to release of posterior recesses and removal of osteophytes as described in grade I flexion management, the posterior cruciate ligament is released first from the femoral end and then from the tibial end. In cases where there is a significant weakening of the posterior cruciate ligament, posterior stabilized components are indicated. If the extension gap is smaller than the flexion gap, the distal femur is respected by 2 mm with cruciate retaining knee components, and then distal femur should be respected by more than 4 mm as it can result in dysfunction of the posterior cruciate ligament due to the elevation of joint line (Figures 1&2) (Table 2).

Fixed flexion	deformity Principles of correction
Grade I (Up to 30°)	Most of the deformity corrects after anesthesia Remove posterior osteophytes adherent to capsular recess Stripping of adherent posterior capsule after bony cut Release of tight collateral ligaments Over resection of distal femur by 2mm if extension gap is tight even after soft release
Grade II (31-60°)	Over resection by 2mm to 4mm - as a rule Soft-tissue release as in grade I Elevate posterior capsule even up to linea aspera Elevate medial and lateral heads of gastrocnemius Transverse dissection of posteromedial capsule in refractive cases Knee immobilizer/splint for 3 weeks Night splint for another 3months
Grade III (>60°)	Start with over resection of distal femur by 4mm Soft-tissue release as in grade II Be ready with constrained implant as over resection may lead to midflexion instability Collateral ligament laxity may need tightening/ advancement In some cases release at hip may be needed Postoperative cast

Table 4: Treatment algorithm for correction of flexion deformity of knee.

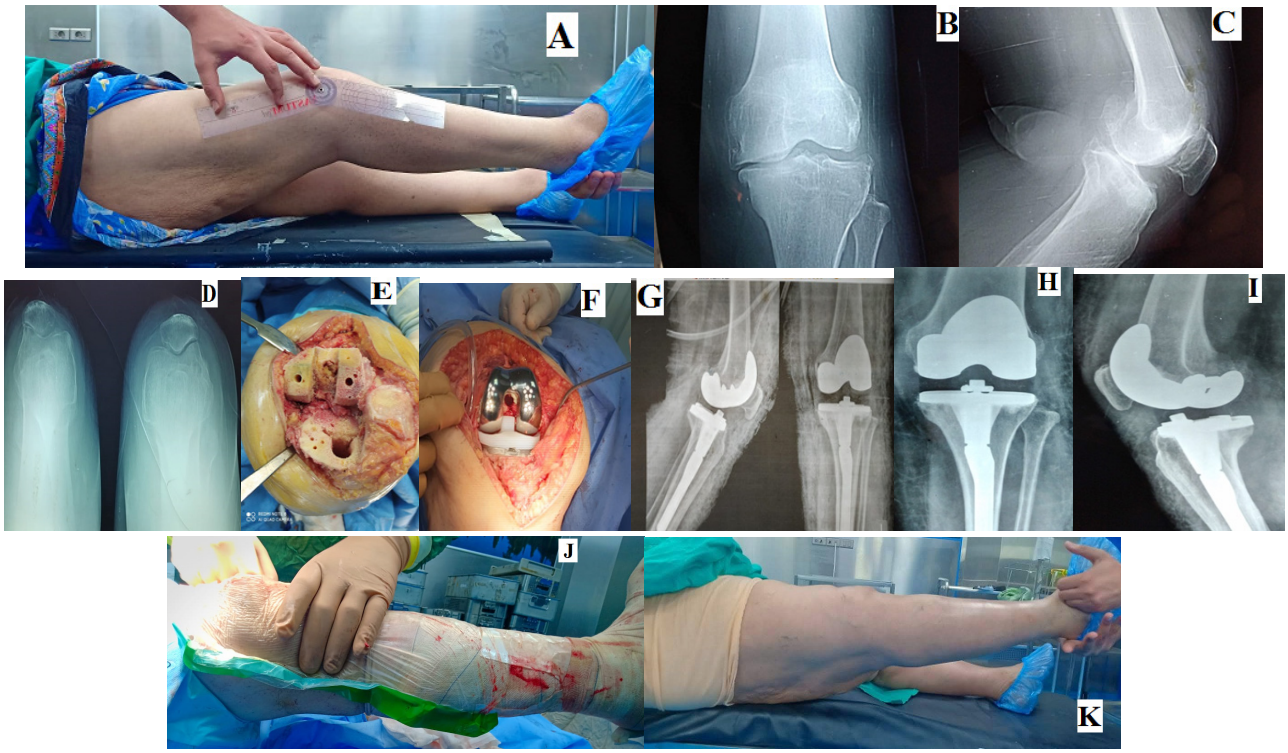

Figure 1: A: preoperative with flexion deformity; B,C,D: preoperative x-ray; E and F intraoperative; G,H,I Postoperative x-ray & J and K: knee after correction of the flexion deformity.

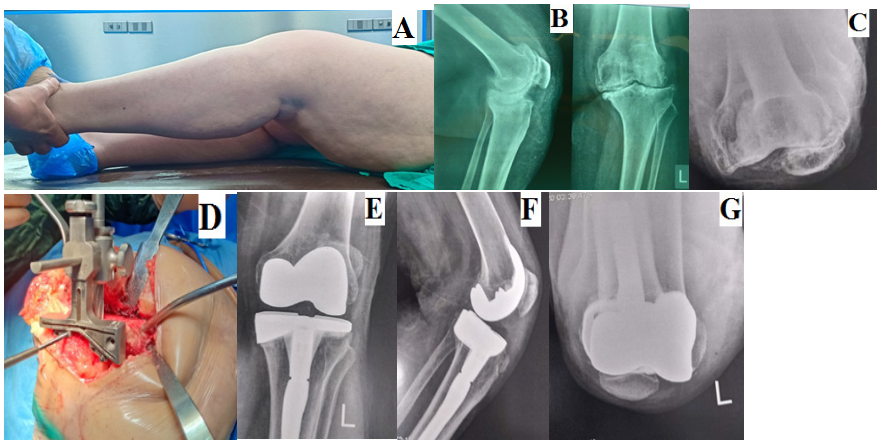

Figure 2: Case 2: A knee flexion deformity; B,C preoperative x-ray; D intraoperative ; E,F,&G final x-ray.

Results

Twenty three patients with 25 knees with primary OA with severe flexion deformity and varus knee deformity 12 patients female (14 knees 56%) and 11 patients male (11 knees 44%). The mean age of patients at the time of sugary was 59±5.97 (range, 48-71) years **(fig 1).** Bilateral TKA was done in 23 patients and unilateral TKA in 21 patients. The average follow-up was 46 months. The varus deformities were in 10 knees with the range 15-25^{o} (Figures 3-5).

Group I: the mean age was 58.85±6.34 (range 48-70) years, the mean flexion deformity 25.36±3.65 (range 20-30°), the ROM improved from 67.5±9.14 (range 45° -70°)(fig 2) to 102.5±4.70 (range 95° -110°)(fig.3) and the mean disease course 3.17±0.51 (range 2.4-3.8) years. The mean Knee Society Score (KSS) improved from 34 (range 0 to 71) to 88 (range 38 to 100) ($p < 0.001$) and the KSS Functional Score from 43 (range 0 to 70) to 86 (range 0 to 100). No knees required manipulations under anaethesia (MUA) and none of the knees had flexion instability (Table 4).

Group II: the mean age was 60±5.69 (range 50-71) years, the mean flexion deformity 45±8.36 (range 35-60°), the ROM improved from 62.7±9.31 (range 50°-80°) to 95±12.04 (range 65°-105°) and the mean disease course 3.99±0.90 (range 2.4-5.3) years. The mean Knee Society Score (KSS) improved from 28(range 0 to 56) to 85 (range 40 to 100) and the KSS Functional Score from 43 (range 0 to 70) to 84 (range 0 to 100). Two knees (8%) required manipulations under anaethesia (MUA) and none of the knees had flexion instability (Table 4).

The postoperative flexion deformity residual was not significant in this study and all patients gain full extension. No improvement in range of motion and residual flexion deformity was recorded after one year. Complications were skin necrosis in two knees and multiple blister formation in three knees. For skin necrosis, thorough debridement was done and the wounds healed satisfactorily. No peroneal nerve palsy occurred in this study.

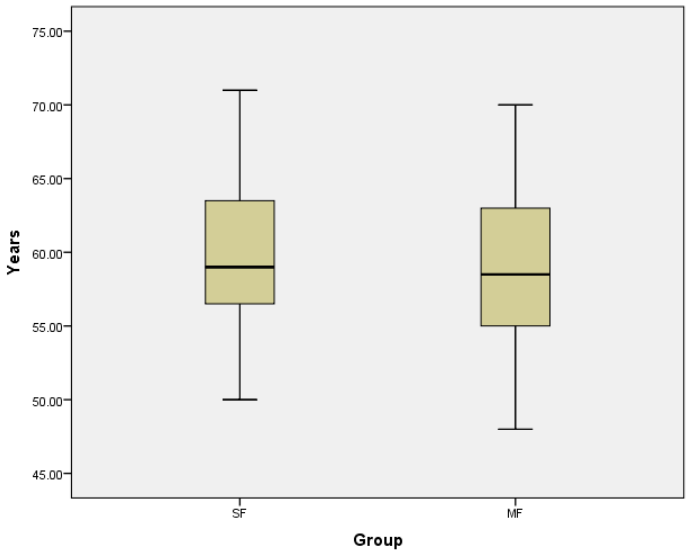

Figure 3: Histogram of the relation between groups and age.

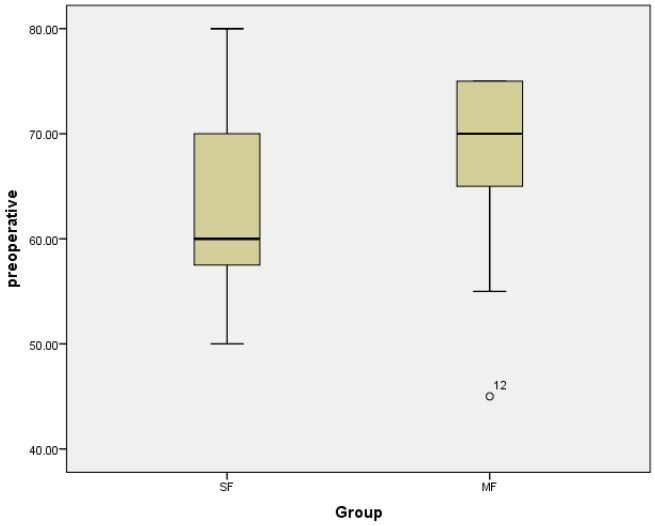

Figure 4: Histogram for the relation between the groups and preoperative ROM.

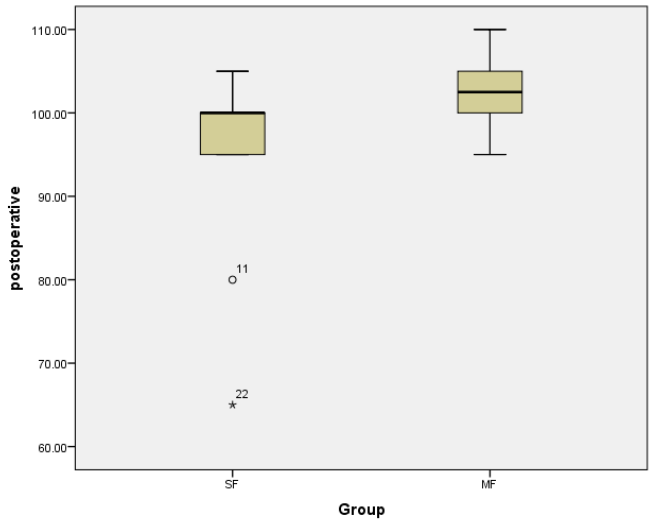

Figure 5: Histogram for the relation between the groups and postoperative ROM.

Discussion

Knees with extreme flexion contracture generally present with back subluxation of the tibia, proximal tibial bone insufficiency joined with valgus distortion, and external rotation of the tibia, which can be in partially attributed to the contracture and the traction of the biceps muscle and iliotibial tract [7].

The contribution of the periarticular delicate tissues is a part of pathology in rheumatoid arthritis. Consequently, it is basic to accomplish amendment of deformity, adjust the medial and lateral soft tissue pressure, and embed the parts precisely. Proper soft tissue balancing as the capsule and the tendons release during arthroplasty is basic for the achievement of the technique [8,9]. Regarding the staying some flexion in activity, it was particularly critical to appropriately situate the individual segments and the subsequent generally arrangement of the lower furthest point in knee with one-phase TKA [10]. In the current investigation, successful TKA was acted in moderate flexion contracture patients as well as in severe flexion deformity of patients, and all cases had great clinical outcomes. When the right hard arrangement is accomplished, it is very important for the good result of TKA that the medial and lateral joint laxity does not exceed more than 2 mm in the stress test (varus and valgus stress testing) when prostheses are implanted. In spite of the fact that TKA can be performed in this difficult patients.[11,12] Complete intraoperative correction of severe flexion deformity introduced a difficult challenging for orthopedic surgeons [11,12]. Different procedures of tending to these deformities have been depicted including extra hard resection, ligamentous discharges, and the utilization of the constraint prosthesis [13]. In any case, a perfect delicate tissue balance is hard to acquire during medical procedure [14].

For achieving an obvious correction of the flexion contracture and also effectively improves the range of motion and the functional recovery of the knee joint after TKA by good soft tissues balancing as ligamentous and capsular release intraoperative [9,12]. However, indications of orthopedic procedure on the flexion contracture were complex and required special attention of the good collateral stability and good experience in TKA surgery [15-17]. In our study early we had instability during TKA procedure. So, the good soft tissue balancing in the form of the release of the ligament and capsule at the time of arthroplasty is mandatory for the good result of TKA procedures in severe flexion contractures of RA patients. Flexion contracture is a typical deformation experienced during all Total knee arthroplasty, and severe fixed deformity requires careful surgical correction with release of the contracted soft tissues and proper management of the femoral bone cuts [18]. Customary techniques for remedying a severe flexion deformity of the knee during total knee arthroplasty can regularly prompt the excessive release of the posterior capsule and medial or lateral collateral ligament. The same number of reports on flexion contracture the management in the knee is accessible in the literature; the peroneal nerve paralysis in TKA was concerned already [19]. Preoperative severe flexion contracture was accepted as the hazard factor for the advancement of the nerve paralysis after TKA [20,21]. In TKA, complete intraoperative remedy of severe flexion deformity is dangerous, which can cause complications, for example, the peroneal nerve paralysis [22]. At present study, the careful decompression of peroneal nerve was performed and we had no peroneal nerve injury. Therefore, the great outcome ought to be because of the proper soft tissue adjusting other than a massive release during arthroplasty.

The achievement of TKA in extreme flexion distortion of patients relies upon numerous elements, including the preoperative state of the joint, careful procedure, and postoperative recovery [23,24]. Braces are acceptable strong gadgets in flexion patients. The experience of Sarokhan, et al [25]. has indicated that the utilization of preoperative and postoperative sequential throws helps enormously in the remedy of serious flexion deformation of the knee. The utilization of dynamic expansion bracing around evening time is gainful to improve flexion contractures for this situation considers. Physiotherapy is another significant segment of flexion patients [26]. In this study, braces are strong gadgets in flexion patients until the some leftover flexion contractures were completely amended. Rand [27] announced that the most significant entanglement influencing the after effects of absolute knee substitution in patients is disease. Paces of disease have been accounted for to be around multiple times more noteworthy in patients with RA than in those with OA [28-30].

Conclusion

The complexity of the surgical procedure increases with an increased flexion deformity of the knee. Less complex deformities are corrected with the usual bone resections and removal of osteophytes. Special attention should be paid to the development of the posterior capsule. Bone resection, especially distal femur, should be reserved in cases where soft tissue release results in insufficient flexion-extension gaps.

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