# Original Article

# Total knee arthroplasty in patients with fixed flexion deformity

Salam A[1], Islam MA[2], Khan MZH[3], Sharif MSB[4], Milon MHR[5], Khan MAH[6], Mahmud MK[7]

## Abstract

***Background:*** *Fixed flexion deformity is a common accompaniment in advanced arthritis of the knee joint. Complete correction of fixed flexion deformity at the time of surgery remains challenging and technically demanding.* ***Objectives:*** *The purpose of our study was to assess the result of total knee replacement using a preset algorithm to assess the effect that a preoperative flexion deformity has on postoperative correction.* ***Materials & Methods:*** *This retrospective study reviewed severe flexion contracture of patients who underwent primary TKA and soft tissue balancing from June 2010 to July 2016. The data included preoperative, intraoperative, and postoperative evaluation at standard intervals and annual follow-up reports.* ***Results:*** *There were no intraoperative complications in this study. The average flexion contractures and ROM were not different between SF and MF groups (1.14 ± 0.27 vs. 1.12 ± 0.35 and 115.72 ± 15.13 vs. 118.34 ± 12.68).* ***Conclusion:*** *TKA can be performed successfully in knees with severe flexion contracture.*

***Key words:*** *Flexion deformity of knee, Total knee arthroplasty.*

***Date of received:*** *25.08.2017*

***Date of acceptance:*** *05.12.2017*

## Introduction

Fixed flexion deformity is a common accompaniment in advanced arthritis of the knee joint. Complete correction of fixed flexion deformity at the time of surgery remains challenging and technically demanding. It is estimated that up to 90% of patients with RA will eventually have the involvement of the knees[1]. Among those patients, progressive destruction of joints leads to the occurrence of flexion contracture in both of their knees and thus these patients are deprived of ambulation for long periods of time[2,3,4]. Underlying the severe flexion deformity is a usually complex combination of musculotendinous, ligamentous, and capsular contractures as well as often bone loss and significant valgus. Although the total knee arthroplasty (TKA) can be performed in this challenging patient[4,5] intraoperative correction of severe flexion deformity presented a challenging situation for orthopedic surgeons[4,6,7].

Bone cuts have to be performed according to the anatomy and implant design and appropriate ligament balancing is required. However, it is potentially a poor strategy, as more bony cuts are needed to get the knee straight in the operation of patients with severe flexion contracture, which creates more problems with respect to instability thereby causing pain and dysfunction[8,9]. However, incomplete intraoperative correction of severe flexion deformity would lead to more residual flexion contracture postoperatively[10]. Therefore, proper soft tissue balancing was very important in TKA for patients with flexion contracture and valgus deformity, which do not only achieve an obvious correction of the flexion contracture but also effectively improve the range of motion and the functional recovery of the knee joint after TKA[11]. Atilla, et. al.[12] reported that pre-operation flexion contracture of 27.5° is an important threshold and patients should be operated before that stage to gain

1. Dr. Abdus Salam, Assistant Professor, Department of Orthopaedic Surgery and Traumatology, NITOR, Dhaka.
2. Dr. Md. Ashraful Islam, Assistant Professor, Department of Orthopaedic Surgery & Traumatology, KYAMCH, Enayetpur, Sirajgonj.
3. Dr. Muhammad Zakir Hossain Khan, Assistant Professor, Department of Nephrology, KYAMCH, Enayetpur, Sirajgonj.
4. Dr. Md. Sayeed-Bin-Sharif, Assistant Professor, Department of Surgery, KYAMCH, Enayetpur, Sirajgonj.
5. Dr. Md. Hafizur Rahman Milon, Registrar, Department of Orthopaedic Surgery & Traumatology, KYAMCH, Enayetpur, Sirajgonj.
6. Dr. Md. Asmaul Hossain Khan, Medical Officer, Department of Orthopaedic Surgery & Traumatology, KYAMCH, Enayetpur, Sirajgonj.
7. Dr. Md. Kaiser Mahmud, Medical Officer, Department of Orthopaedic Surgery & Traumatology, KYAMCH, Enayetpur, Sirajgonj.

**Correspondence:** Dr. Abdus Salam, Assistant Professor, Department of Orthopaedic Surgery and Traumatology, NITOR, Dhaka.
e-mail : salamdr.196668@gmail.com

maximum benefit with minimal gait abnormalities. Mitsuyasu, et. al.[13] reported that flexion contracture eventually existed if the contracture was more than 15° 3 months after TKA surgery in severe flexion contracture of the knees. Cheng, et. al.[14] reported that patients with a preoperative fixed flexion deformity show continued improvement in their fixed flexion up to 10 years post-arthroplasty and have similar outcomes to those with no preoperative fixed flexion. Along with our increased understanding of the patients with flexion contracture, special attention should be paid to the inferior bone density, and the soft tissue needs to be treated with special care. With the development of technique and device of TKA, it is recommended to limit bone resection with mandatory release of the posterior capsule and the collateral ligaments to get the knee straight in the operation and stable in the post-operation in the most severe cases[15]. Although it has been reported that the release of the posterior capsule and the collateral ligaments until some flexion for severe flexion contractures remains in patients, the debate continues as to which flexion contractures should be totally or partly corrected in operation[10, 16-18]. It is very important for the modern TKA not only to restore a balance between the osteotomy and ligament release in procedures but also to maintain the joint tension in procedures to prevent joint laxity in the unusual condition of severe flexion contracture deformity of the knee. The purpose of this paper was to report our experience on knees with severe flexion contractures performed with one-stage TKA.

## Materials & Methods

This retrospective study reviewed severe flexion contracture of patients who underwent primary TKA and soft tissue balancing from June 2010 to July 2016. The data included preoperative, intraoperative, and postoperative evaluation at standard intervals and annual follow-up reports. All patients were diagnosed as arthritis of knee. The inclusion criteria were knees had flexion contracture with valgus deformity. Exclusion criteria included pathologic conditions of the RA knee (trauma, tumor, or infection). Four patients initially fulfilled the study criteria. According to the criterion of flexion contracture which is beyond or less 30°, patients available for analysis were divided into two groups, i.e., severe flexion group (SF) (with flexion contracture beyond 30°; 4cases initially, and moderate flexion group (MF) (with flexion contracture less 30° and beyond 10°; 4 cases initially. The data of age and sex distribution, flexion, range of motion (ROM) and knee society Rating System (KSS) score, and the course of disease are shown in Table I.

**Table I**

| Group (case) | Sex | | Age (years) | Flexion (deg) | ROM (deg) | KSS | Course of disease (year) |
|---|---|---|---|---|---|---|---|
| | Male | Female | | | | | |
| SF (2) | 2 | 2 | 50.32 ± 8.69 | 50.84 ± 17.37 | 31.86 ± 11.25 | 27.48 ± 13.29 | 12.16 ± 2.25 |
| MF (2) | 1 | 3 | 48.68 ± 5.58 | 19.67 ± 10.86 | 68.16 ± 15.37 | 43.62 ± 15.46 | 9.30 ± 1.08 |

Patient data (data expressed as means ± SD)

There was no significant difference between two groups ($p>0.05$). The TKA surgical procedure included a standard anteromedial approach, the use of an intramedullary femoral and extramedullarytibial alignment rod, measured bone resection, and differential ligament balance in flexion and extension[9]. Measured resection implies that the amount of bone resected from the intact compartment of the joint equals the thickness of the implant, while restoring correct alignment by resecting the bone perpendicular to the mechanical axis. Based on the correct osteotomy, recovering full extension at the end of surgery is mandatory, by first releasing the posterior capsule and the collateral ligaments from their osteophytes and secondly by extending the distal femoral cut where necessary. Once the correct bony alignment is achieved, the flexion and extension spaces are secured equally without massive soft tissue release and an additional distal femur cut. It is very important in procedures not only to restore a balance between the osteotomy and ligament release but also to maintain the joint tension to prevent joint laxity in severe flexion contracture of knees. All patients received low molecular weight heparin as prophylaxis for deep vein thrombosis; the first dose was initiated 8 h after the operation. All patients received three doses of Meropenem 1gm daily for 7 days and Flucloxacillin as prophylaxis for infection, with the first dose administered at the induction of anesthesia. The same protocol for postoperative management was utilized in both groups, which included bedside continuous passive motion therapy, physical therapy with partial weight bearing, and quadriceps and hamstring strengthening exercises starting on the second postoperative day.

Splints are supportive devices for flexion in patients until the some residual flexion contractures were totally corrected. The knees were assessed preoperatively and at yearly intervals after operation using KSS[19]. Furthermore, AP and lateral knee X-rays are performed to detect any radiolucencies to measure the deformity on the X-ray film (Figures 1 and 2).

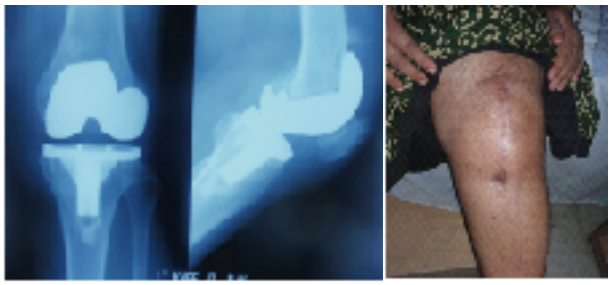

**Figure 1**

Plain anteroposterior and lateral radiographs of a 43-year-old female which reveal joint destruction. This case is a 43-year-old female patient with flexion contractures deformity. After TKA on the left knee, the 27° flexion contracture was completely corrected postoperatively.

**Figure 2**

One plain anteroposterior and lateral radiographs of a 49-year-old female which reveal joint destruction. This case is a 49-year-old female patient with flexion contractures deformity. After TKA on left knee, the 53° flexion contracture was completely corrected postoperatively. All measurements were performed by a single observer and are expressed as means ± standard deviation (SD).

## Results

There were no intraoperative complications in this study. Soft tissue release surgery and additional bone cuts were performed in all cases of severe flexion contractures. Afterwards, cases had follow-up from 12 to 48 months (average of 24 months), The flexion contractures and ROM were shown in Table II. The average flexion contractures and ROM were not different between SF and MF groups (1.14 ± 0.27 vs. 1.12 ± 0.35 and 115.72 ± 15.13 vs. 118.34 ± 12.68). As shown in Table 2, the KSS improved and was better in MF group than SF group (87.15 ± 8.64 vs. 80.67 ± 9.35). Based on the Hospital for Special Surgery score, the rate of good or excellent was higher in MF group than SF group (SF = excellent, 2 knees; good, 1 knees; general, 1knees; and poor, 0knees; MF = excellent, 3 knees; good, 1 knees; and general, 0 knees).

**Table II**

| Group | Flexion (deg) | | ROM (deg) | | KSS score | |
|---|---|---|---|---|---|---|
| | Pre-OP | Post-OP | Pre-OP | Post-OP | Pre-OP | Post-OP |
| SF | 50.84±17.37 | 1.14±0.27 a | 31.86±11.25 | 115.72±15.13 a | 27.48±13.29 | 80.67±9.35 a |
| MF | 19.67±10.46 | 1.12±0.35 a | 68.16±15.37 | 118.34±12.68 a | 43.62±15.46 | 87.15±8.64 a |

Clinical outcomes (data expressed as means±SD) aNo significant difference in these groups ($p>0.05$). OP, operation.

There were no infection complication and no cases with patellar dislocation or subluxation seen in this study. There were 1cases with mild mediolateral instability in the SF for a massive release of soft tissue during TKA.

## Discussion

Knees with severe flexion contracture usually present with posterior subluxation of the tibia, proximal tibial bone deficiency combined with valgus deformity, and external rotation of the tibia, which can be partially attributed to the contracture and the traction of the biceps muscle and iliotibial tract[20]. The involvement of the periarticular soft tissues is part of the constellation of pathology in rheumatoid arthritis. Hence, it is critical to achieve correction of deformity, equalize the medial and lateral soft tissue tension, and implant the components accurately. Appropriate soft tissue balancing in the form of ligament and capsular release at the time of arthroplasty is essential to the success of the procedure[21,22]. As to the remaining some flexion in operation, it was especially important to properly position the individual components and the resulting overall alignment of the lower extremity in knee with one-stage TKA[18]. In the present study, successful TKA was performed in not only in moderate flexion contracture patients but also in severe flexion deformity of patients, and all cases had good clinical results. Once the correct bony alignment is achieved, it is very important for the success 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. Although TKA can be performed in this challenging patients[4,5] complete intraoperative correction of severe flexion deformity presented a challenging situation for orthopedic surgeons[4,6]. Various techniques of addressing these deformities have been described including additional bony resection, ligamentous releases, and the use of increasing constraint prosthesis[16]. However, an ideal soft tissue balance is difficult to obtain during surgery[23]. Appropriate soft tissue balancing in the form of ligament and capsular release at the time of arthroplasty is essential to the success of TKA procedures, which not only achieves an obvious correction of the flexion contracture but also effectively improves the range of motion and the functional recovery of the knee joint after TKA[9,20].

However, indications of orthopedic procedure on the flexion contracture were complex and required special consideration of the adequate collateral stability and extensive experience in TKA surgery[2,24-26]. In our early experience on severe flexion contractures in one patient, instability was caused by a massive release of soft tissue during TKA procedure. Therefore, appropriate soft tissue balancing in the form of ligament and capsular release at the time of arthroplasty is essential to the success of TKA procedures in severe flexion contractures of RA patients.

Flexion contracture is a common deformity encountered during total knee arthroplasty, and severe fixed deformities require surgical correction with release of the contracted soft tissues and appropriate management of the femoral bone resection[27]. Traditional methods for correcting a severe flexion deformity of the knee during total knee arthroplasty can often lead to the excessive release of the posterior capsule and medial or lateral collateral ligament[28]. As many reports on flexion contracture management in the knee are available in the literature, the peroneal nerve palsy in TKA was concerned previously[2,3]. Preoperative severe flexion contracture was assumed as the risk factor for the development of the nerve palsy after TKA[29,30]. In TKA, complete intraoperative correction of severe flexion deformity is dangerous, which can cause complications such as the peroneal nerve palsy[31]. At present study, the surgical decompression of peroneal nerve was not performed and the transient peroneal nerve palsy had recovered after conservative therapy. Thus, the good result should be due to the appropriate soft tissue balancing other than a massive release at the time of arthroplasty. The success of TKA in severe flexion deformity of patients depends on many factors, including the preoperative condition of the joint, surgical technique, and postoperative rehabilitation[32-34]. Splints are good supportive devices in flexion patients. The experience of Sarokhan, et. al.[10] has shown that the use of preoperative and postoperative serial casts aids greatly in the correction of severe flexion deformity of the knee. The use of dynamic extension splinting at night is beneficial to improve flexion contractures in this case studies. Physiotherapy is another important component of flexion patients[33]. In this study, splints are supportive devices in flexion patients until the some residual flexion contractures were totally corrected. Rand[35] reported that the most important complication affecting the results of total knee replacement in patients is infection. Rates of infection have been reported to be approximately three times greater in patients with RA than in those with OA[36,37].

## Conclusions

TKA can be performed successfully in knees with severe flexion contracture. It is very important in TKA to maintain the joint stability in the condition of severe flexion contracture deformity of the knee.

## References

1. Kajino A, Yoshino S, Kameyama S, Kohda M, Nagashima S: Comparison of the results of bilateral total knee arthroplasty with and without patellar replacement for rheumatoid arthritis - a follow-up note. J Bone Joint Surg Am. 1997, 79A (4): 570-574.

2. Aglietti P, Windsor RE, Buzzi R, Insall JN: Arthroplasty for the stiff or ankylosed knee. J Arthroplasty. 1989, 4 (1): 1-5. 10.1016/S0883-5403(89)80046-4. DOI.

3. Chmell MJ, Scott RD: Total knee arthroplasty in patients with rheumatoid arthritis. An overview. ClinOrthopRelat Res. 1999, 366: 54-60.

4. Tew M, Forster IW: Effect of knee replacement on flexion deformity. J Bone Joint Surg Br. 1987, 69 (3): 395-399.

5. McPherson EJ, Cushner FD, Schiff CF, Friedman RJ: Natural history of uncorrected flexion contractures following total knee arthroplasty. J Arthroplasty. 1994, 9 (5): 499-502. 10.1016/0883-5403(94)90096-5. DOI.

6. Firestone TP, Krackow KA, Davis JD, Teeny SM, Hungerford DS: The management of fixed flexion contractures during total knee arthroplasty. ClinOrthopRelat Res. 1992, 284: 221-227.

7. McGrath MS, Mont MA, Siddiqui JA, Baker E, Bhave A: Evaluation of a custom device for the treatment of flexion contractures after total knee arthroplasty. ClinOrthopRelat Res. 2009, 467 (6): 1485-1492.10.1007/s11999-009-0804-z.DOI.

8. Abe S, Kohyama K, Yokoyama H, Shigeru M, Yasuhiro T, Natsuko N, Yasuhiro S, Hiroyuki F: Total knee arthroplasty for rheumatoid knee with bilateral, severe flexion contracture: report of three cases. Mod Rheumatol. 2008, 18 (5): 499-506. DOI. 10.1007/s10165-008-0079-3.

9. Massin P, Petit A, Odri G, Ducellier F, Sabatier C, Lautridou C, Cappelli M, Hulet C, Canciani JP, Letenneur J, Burdin P, Sociétéd'orthopédie de l'oues: Total knee arthroplasty in patients with greater than 20 degrees flexion contracture. Orthop Traumatol Surg Res. 2009, 95 (4 Suppl 1): S7-S12.

10. Sarokhan AJ, Scott RD, Thomas WH, Sledge CB, Ewald FC, Cloos DW: Total knee arthroplasty in juvenile rheumatoid arthritis. J Bone Joint Surg Am. 1983, 65 (8): 1071-1080.

11. Ito J, Koshino T, Okamoto R, Saito T: 15-year follow-up study of total knee arthroplasty in patients with rheumatoid arthritis. J Arthroplasty. 2003, 18 (8): 984-992. DOI,10.1016/S0883-5403(03)00262-6.

12. Atilla B, Caglar O, Pekmezci M, Buyukasik Y, Tokgozoglu AM, Alpaslan M: Pre-operative flexion contracture determines the functional outcome of haemophilicarthropathy treated with total knee arthroplasty. Haemophilia. 2012, 18 (3): 358-363.DOI. 10.1111/j.1365-2516.2011.02695.x.

13. Mitsuyasu H, Matsuda S, Miura H, Okazaki K, Fukagawa S, Iwamoto Y: Flexion contracture persists if the contracture is more than 15 degrees at 3 months after total knee arthroplasty. J Arthroplasty. 2011, 26 (4): 639-643.DOI, 10.1016/j. arth. 2010.04.023.

14. Cheng K, Ridley D, Bird J, McLeod G: Patients with fixed flexion deformity after total knee arthroplasty do just as well as those without: ten-year prospective data. IntOrthop. 2010, 34 (5): 663-667. DOI, 10.1007/s00264-009-0801-6.

15. Koshino T, Okamoto R, Takagi T, Yamamoto K, Saito T: Cemented ceramic YMCK total knee arthroplasty in patients with severe rheumatoid arthritis. J Arthroplasty. 2002, **17** (8): 1009-1015. DOI, 10.1054/arth.2002.35826.

16. Berend KR, Lombardi AV, Adams JB: Total knee arthroplasty in patients with greater than 20 degrees flexion contracture. ClinOrthopRelat Res. 2006, 452: 83-87.

17. Goudie ST, Deakin AH, Ahmad A, Maheshwari R, Picard F: Flexion contracture following primary total knee arthroplasty: risk factors and outcomes. Orthop. 2011, 34 (12): e855-e859.

18. Quah C, Swamy G, Lewis J, Kendrew J, Badhe N: Fixed flexion deformity following total knee arthroplasty. A prospective study of the natural history. Knee. 2012, 19 (5): 519-521. DOI,10.1016/ j.knee.2011.09.003.

19. Insall JN, Dorr LD, Scott RD, Scott WN: Rationale of the Knee Society clinical rating system. Clin Orthop Relat Res. 1989, 248: 13-14.

20. Tanzer M, Miller J: The natural history of flexion contracture in total knee arthroplasty. A prospective study. ClinOrthopRelat Res. 1989, 248: 129-134.

21. Ojima T, Yokogawa A, Yamakado K, Ogawa K, Kobayashi T, Nakashima A, Ogawa H: Bilateral total knee arthroplasty after spontaneous osseous ankylosis in rheumatoid arthritis. Mod Rheumatol. 2005, 15 (2): 139-143. DOI, 10.1007/s10165-005-0380-3.

22. Smilowicz M, Jung L: Total knee arthroplasty in patients with severe deformities due to rheumatoid arthritis. OrtopTraumatolRehabil. 2005, 7 (6): 673-679.

23. Whiteside LA: Selective ligament release in total knee arthroplasty of the knee in valgus. ClinOrthopRelat Res. 1999, 367: 130-140.

24. Kim JM, Moon MS: Squatting following total knee arthroplasty. ClinOrthopRelat Res. 1995, 313: 177-186.

25. Laskin RS, O'Flynn HM: The Insall Award. Total knee replacement with posterior cruciate ligament retention in rheumatoid arthritis. Problems and complications. ClinOrthopRelat Res. 1997, 345: 24-28.

26. McAuley JP, Engh GA: Constraint in total knee arthroplasty: when and what?. J Arthroplasty. 2003, 18 (3 Suppl 1): 51-54.

27. Scuderi GR, Kochhar T: Management of flexion contracture in total knee arthroplasty. J Arthroplasty. 2007, 22 (4 Suppl 1): 20-24.

28. Meftah M, Blum YC, Raja D, Ranawat AS, Ranawat CS: Correcting fixed varus deformity with flexion contracture during total knee arthroplasty: the "inside-out" technique: AAOS exhibit selection. J Bone Joint Surg Am. 2012, 94 (10): e66.

29. Knutson K, Leden I, Sturfelt G, Rosen I, Lidgren L: Nerve palsy after knee arthroplasty in patients with rheumatoid arthritis. Scand J Rheumatol. 1983, 12 (3): 201-205. DOI.10.3109/03009748309098533.

30. Omeroglu H, Ozcelik A, Turgut A: Bilateral peroneal nerve palsy after simultaneous bilateral total knee arthroplasty. Report of a case with rheumatoid arthritis. Knee Surg Sports TraumatolArthrosc. 2001, 9 (4): 225-227. DOI, 10.1007/s001670100211.

31. Lu H, Mehdi G, Zhou D, Lin J: Simultaneous bilateral total knee arthroplasty for rheumatoid arthritis. Chin Med J (Engl). 1996, 109 (12): 937-940.Google Scholar

32. Figgie HE, Brody GA, Inglis AE, Sculco TP, Goldberg VM, Figgie MP: Knee arthrodesis following total knee arthroplasty in rheumatoid arthritis. ClinOrthopRelat Res. 1987, 224: 237-243.

33. Papotto BA, Mills T: Treatment of severe flexion deficits following total knee arthroplasty: a randomized clinical trial. OrthopNurs. 2012, 31 (1): 29-34. DOI, 10.1097/NOR.0b013e3182419662.

34. Smilowicz M: Problems involved in total knee arthroplasty for rheumatoid arthritis patients. OrtopTraumatolRehabil. 2000, 2 (4): 27-31.

35. Rand JA, Ilstrup DM: Survivorship analysis of total knee arthroplasty. Cumulative rates of survival of 9200 total knee arthroplasties. J Bone Joint Surg Am Vol. 1991, 73 (3): 397-409.

36. Poss R, Thornhill TS, Ewald FC, Thomas WH, Batte NJ, Sledge CB: Factors influencing the incidence and outcome of infection following total joint arthroplasty. ClinOrthopRelat Res. 1984, 182: 117-126.

37. Wilson MG, Kelley K, Thornhill TS: Infection as a complication of total knee-replacement arthroplasty. Risk factors and treatment in sixty-seven cases. J Bone Joint Surg Am. 1990, 72 (6): 878-883.