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Total Knee Arthroplasty in Bilateral Severe Fixed Flexion Deformity: A Case Report

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Abstract

Background: Severe bilateral Fixed flexion deformity of the knees resulting from irreversible joint damage is a disabling complication of long-standing rheumatoid arthritis, associated with loss of ambulatory ability. While Total knee Arthroplasty is an effective treatment for such patients, it poses significant intra-operative technical demands and challenges with post-operative rehabilitation.

Method: We report a case of Severe Fixed flexion deformity of both knees in a 46-year-old male with long-standing rheumatoid arthritis, non-ambulatory since 5 years, treated by sequential total knee arthroplasty.

Results: Treating Severe bilateral Fixed flexion deformities in a non-ambulatory patient by sequential total knee Arthroplasty using standard implants yielded complete deformity correction and pain-free restoration of active range of motion in both knees with stable independent ambulation and complete restoration of lower limb function within 3 months of surgery.

Conclusion: Our case is particularly remarkable for complete restoration of stable, pain-free restoration of ambulation within 3 months in a patient with severe bilateral knee fixed flexion deformities who had been non-ambulatory for 5 years preceding his bilateral sequential total knee arthroplasty.

Keywords: Fixed flexion deformity, Total knee arthroplasty, Common peroneal nerve, Rheumatoid arthritis.

Introduction

Severe fixed flexion deformity of the knees is known sequelae of long-standing rheumatoid arthritis. Achieving a well-balanced, well-aligned and stable knee during total knee arthroplasty in these cases is technically demanding. Reports of successful correction of bilateral severe fixed flexion deformities of 60° or more by sequential TKA in a non-ambulatory patient are relatively few. We are reporting a case of severe bilateral knee fixed flexion deformities in a 46 year-old-male with long-standing Rheumatoid arthritis, non-ambulatory since 5 years, successfully treated by sequential total knee arthroplasty.

Case report

A 46-year-old man presented to us with complaints of inability to stand and walk along with stiffness in both knees since 5 years. He had been diagnosed with seropositive Rheumatoid Arthritis 14 years ago, and was on erratic treatment since then.

On examination, both his knees were ankylosed in 90 degrees fixed flexion (Fig. 1). The deformity was not correctable. Both hips, ankles and feet were normal. Features of rheumatoid hand were noted bilaterally.

Pre-operative plain radiographs (Fig. 2) revealed diminished tibiofemoral joint spaces on the lateral view taken in the angle of fixed flexion, and patellofemoral joint spaces on the skyline view. Osteophytes in the suprapatellar region, anterior joint space and posterior to the femoral condyles were seen on the lateral views of both knees, more prominently on the right side. A long-leg alignment film was not possible since the patient was unable to stand.

After pre-operative counseling about the complexity of the surgery, the risks of neurovascular compromise following one-stage correction of severe long-standing knee flexion deformities, and the challenges in rehabilitation, the patient was admitted for bilateral sequential total knee arthroplasty.

The 90 degrees fixed flexion deformity noted in both knees on pre-operative clinical examination remained unchanged on examination under anaesthesia and was not correctable on manual manipulation under anaesthesia.

The right TKA was performed first, followed a week later by the left TKA. For both sides, a similar technique was employed. Pre-emptive Common peroneal nerve neurolysis was done just prior to TKA for both knees. TKA was performed by a standard medial parapatellar approach, using intramedullary femoral and extramedullary tibial alignment jigs, measured bone resection

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Figure 1: Pre-op clinical images – sitting on wheelchair, lateral profile

Figure 2: Pre-operative X-Rays of both knees, AP, Lateral & skyline views

and differential ligament balancing in flexion and extension technique [1]. Soft tissue correction of the fixed flexion deformities were sequentially accomplished by removing posterior osteophytes adherent to capsular recess, resecting the posterior cruciate ligament & pie crusting of LCL elevating, the tight posterior capsule up to linea aspera and elevating the medial and lateral heads of gastrocnemius. 7 mm tibial resection was done, using the standard cutting jig with built-in 3 degrees slope. Intra-operatively, the lateral compartment showed significantly more wear than the medial side, suggestive of an associated valgus deformity that was not apparent on pre-operative clinical examination due to the fixed flexion deformity. The distal femur was cut with the intra-medullary cutting guide set at an angle of 3 degree valgus.

Over-resection of the distal femur by 4 mm was necessary to achieve a balanced and symmetrical extension and flexion gaps intra-operatively. Full extension and complete correction of severe flexion deformities of both knees was achieved both on gap balance testing and during implant trialing. 3 degree external rotation with respect to posterior condylar axis was set while doing the femoral preparation. The above cut was parallel to epicondylar axis and perpendicular to Whiteside's line.

Standard Posterior stabilized cemented implants with high-flexion XLPE inserts (Implants: Smith & Nephew Co.) were used, and the use of constrained implants or stems were found to be unnecessary. The patellar articular cartilage was found relatively uninvolved; hence the patellae were not resurfaced.

Post-operatively, a bi-valved cylindrical cast with knee in complete extension was applied for 7 days.

Image (Fig. 3) of the patient in ward after right TKA shows right knee immobilized in full extension and the left knee with flexion deformity.

Postoperatively there were no distal neurovascular deficits.

Plain X-rays were performed immediately after the surgery (Fig. 4 & 5), which confirmed complete deformity correction in both planes, restoration of alignment and optimal implant positioning.

From post-operative day 8 onwards, we applied our standard rehabilitation regime including isometric quadriceps exercises, active and active assisted knee mobilization, continuous passive motion and full weight bearing ambulation with a knee brace. Since the quadriceps had been inactive and the hamstring contracture was present for 5 years prior to our procedure bilaterally, faradic muscle stimulation was employed in addition to the regular quadriceps drill and hamstring stretching exercises to help achieve full, active extension.

Both knees showed steady progress in the active Range of movement post-operatively, as summarized in Table 1.

The patient was independently ambulatory without walking aids by the 8th post-op week. Bilateral, full, active extension and optimal quadriceps strength was achieved by 3 months post-op,

Figure 3: Image of the patient in ward after right TKA with right knee immobilized in full extension and the left knee with fixed flexion deformity.

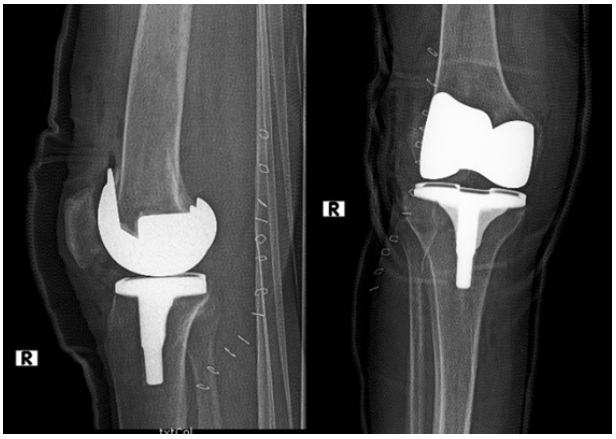

Figure 4: Immediate Postoperative X-rays of Right Knee, AP & lateral views

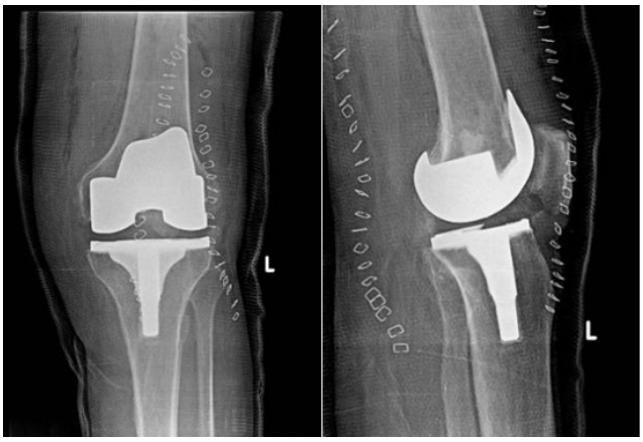

Figure 5: Immediate Postoperative X-rays of Left Knee, AP & lateral views

Table 1: Progress of Active ROM both knees up to 1 year post-op

Follow-Up	Active Range Of Motion	Extension Lag
3 weeks	30-90 degrees	30 degrees
6 weeks	10-110 degrees	10 degrees
3 months	0-120	0 degrees
6 months	0-130	0 degrees
1 year	0-130	0 degrees

with the flexion range of 120 degrees at this stage (Fig. 6), which further improved to 130 degrees at 6 months follow-up. The knees remained stable in coronal and sagittal planes during the entire post-operative period.

Plain X-rays done at 3 months post-op follow up (Fig. 7) confirmed optimal implant positioning and fixation. On routine follow up there were no neurovascular deficits. In particular, the common peroneal nerve retained normal function during the entire follow-up period.

Results

Complete correction of severe flexion deformities of both knees ankylosed at 90 degrees of flexion was achieved intra-operatively. There were no intra-operative or post-operative complications. At one year follow-up (Fig. 8), patient had neutrally aligned pain-free, stable knees with complete active extension and flexion range of 130 degrees bilaterally, and was fully ambulant with a normal gait pattern. The patellar tracking was normal.

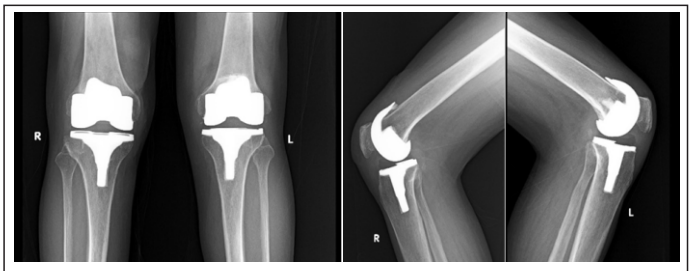

Figure 7: 3 months follow up X-rays of both knees, AP view & Lateral view with knees flexed

Figure 6: 3 months follow up Clinical pictures e showing Active Knee range of movements in both knees from 0 to 120 degrees

The widely used knee society scoring system (KSS) [2] was used for clinical and functional evaluation of the result, and improved significantly from a pre-operative score of 25 to 85 post-operatively.

Discussion

Severe Fixed flexion deformity of the knees is a known sequelae of long-standing Rheumatoid arthritis. These deformities usually result from a complex combination of musculo-tendinous, ligamentous, and capsular contractures with associated adaptive bone loss.

Severe flexion deformities require surgical correction with release of the contracted soft tissues and appropriate femoral bone resection. Achieving a well-balanced, well-aligned and stable knee during total knee arthroplasty in these cases is technically demanding. In patients with fixed flexion deformity, the flexion gap is more than the extension gap, caused by tight

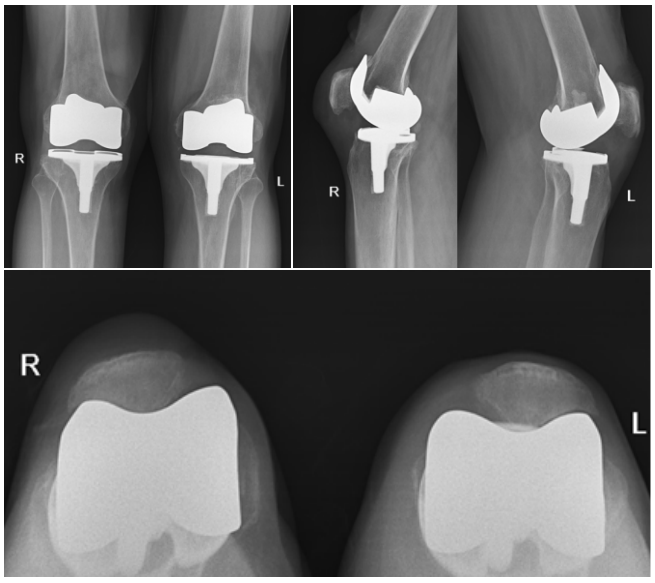

Figure 8: One year follow up X-rays of both knees, AP view, Lateral & skyline view with knees flexed

posterior soft tissue structures. Performing sequential soft tissue releases to achieve soft tissue balancing and judicious bone cuts will help achieve complete deformity correction without creating iatrogenic instability. Soft tissue management of severe flexion deformities during TKA includes osteophyte removal, release of tight collateral ligaments, PCL resection, release of medial and lateral heads of the gastrocnemius and posterior capsule separation [3]. Proper soft tissue balancing is crucial to improve the functional recovery and the range of motion of the knee after TKA [4].

In this case, after the primary proximal tibial and distal femoral resection, the following sequence of soft tissue releases and bony resection were deployed to achieve complete correction of the severe flexion deformity. To begin with, osteophytes were removed to the level of native articular margins. This was followed by complete release of the PCL. Next, the adherent posterior capsule was stripped proximally off the femur all the way upto the linea aspera. The tendinous origins of the gastrocnemius were then released. As the flexion contracture persisted in spite of all these soft tissue releases, an additional distal femoral resection of 4 mm was done. Distal femoral resection more than 4 mm positions the joint line more proximally, which functionally lengthens the collateral ligaments and posterior capsule towards extension, without compromising stability in flexion. However, caution should be exercised in performing additional resection, since overzealous bone resection on the femoral side could alter patella-femoral kinematics and over-resection of the proximal tibia could lead to instability [5, 6], while under-resection will leave behind residual flexion contracture [7].

Intra-operatively, on extension we observed that the posterolateral soft tissue sleeve was contracted. Hence pie crusting of the posterolateral corner, including the LCL was done to correct the valgus alignment of the knee. Equal, balanced flexion and extension gaps were achieved after this step. In our case, the use of constrained implants were not necessary as there was no mid flexion instability.

In balancing the valgus knee, if only the extension gap is tight, iliotibial band pie crusting/release can be considered. Release of popliteus tendon will increase the flexion gap more than the extension gap so the popliteus should be released only if it is tight.

In TKA, complete intraoperative correction of severe flexion deformity is associated with the risk of post-operative peroneal nerve palsy. Preoperative flexion contracture >30 degrees is considered to be a risk factor for the development of the nerve palsy after TKA [8, 9]. In our case, considering that both knees were ankylosed in 90 degrees of flexion, pre-emptive surgical decompression of peroneal nerve was performed just prior to TKA bilaterally.

Achieving a successful outcome with TKA in severe flexion deformities depends on many factors, most importantly meticulous sequential soft tissue release, judicious bone cuts and customized postoperative rehabilitation [10, 11].

Clinical Relevance

Bilateral severe fixed flexion deformities of the knees is a devastating complication of Rheumatoid Arthritis which may render the patient non-ambulatory. Our case illustrates that a carefully performed Total Knee Arthroplasty can achieve excellent clinical and functional results in these patients.

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