Effectiveness of the Ilizarov Method in the Management of Fixed Flexion Deformities of the Knee Joint

Karike Vishnu[1], Yeduguri Hariprasad Reddy[1]

ABSTRACT

Introduction: Fixed flexion deformity of the knee is a common and disabling problem, especially in India where poliomyelitis is still a great problem. Correction of severe deformities has been a challenge to orthopaedic surgeons over the years. The Ilizarov method of treatment has revolutionised the management of severe and complex deformities. Study objectives were to see the effectiveness of the Ilizarov method in the management of fixed flexion deformities of the knee joint and to identify the various associated complications.

Material and methods: It is a combined retrospective and prospective study of all the patients who underwent correction of fixed flexion deformities of the knee by the Ilizarov method, in M S Ramaiah Medical Teaching and Memorial Hospitals.

Results: 49 patients (59 knees) were included in the study. The age at primary surgery ranged from 4 to 24 years with an average of 16.5 years. The diagnosis was Post Polio Residual Paralysis (PPRP) in 38 patients, Polio like illness in 1 patient, Multiple Congenital Contractures (MCC) in 3 patients, meningomyelocoele in 2 patients, Proximal Focal Femoral Deficiency who developed. FFD knee during femoral lengthening in 1 patient, Post Septic arthritis in 2 and Post Traumatic in 2 patients. The severity of the Fixed Flexion Deformity of the Knee ranged from 10° to 150°, with an average of 71°. The mean follow up after fixator removal was for 20 months ranging from 2 months to 6 years and 1 month. Deformity correction was done to neutral or 5-10 degrees of recurvatum. This was achieved in all but 2 knees. There was recurrence of less than 20° in 9 patients. 3 patients developed recurrence of the deformity more than 20° which precluded walking. Loss of terminal arc of motion was from 0% to 85.71% with a mean of 20.20%. There was Pin tract infection in 76%, posterior subluxation of tibia in 25.42%, stress fractures in 15.25%, and progressive equinus in 13.55%.

Conclusion: In view of the immense advantages of the Ilizarov method, this should be the recommended method in the correction of severe fixed flexion deformities of the knee, correction of multiple and complex limb deformities and when other methods have failed, in spite of the associated complications.

Keywords: Fixed Flexion Deformity, Ilizarov External Fixator, Gradual Distraction

INTRODUCTION

It is estimated that in India there are about 10 million orthopaedically handicapped children and adults with limb deformities. Fixed flexion deformity of the knee is common and causes great disability. It increases the work load of the quadriceps during walking, and if associated with quadriceps weakness, results in a hand to knee gait. If severe, it often results in a non ambulant victim. Post polio residual paralysis (PPRP) is still a common cause of disabling FFD knee in our country.[1] Other common causes are trauma, rheumatoid arthritis, infective arthritis, post burns contractures, congenital anomalies like multiple congenital contractures or the multiple pterygium syndrome and neuromuscular causes (cerebral palsy, meningomyelocoele).[2,3] There are many methods for managing flexion contracture of the knee including serial casting, bipolar traction, posterior soft tissue release, osteotomy, and femoral shortening.

These have been used alone or in combination with various degrees of success depending on the severity of the deformity and its aetiology.[2] Surgical therapy of fixed flexion deformity of the knee consists of tendon lengthening with or without capsular release as well as extension osteotomy of the distal femur. The former method often results in an incomplete correction in heavy contractures with a high risk of skin necroses and traction injury of the nerves following acute correction. Contracture correction by osteotomy can lead to secondary osseous deformity.[3] The surgical correction of fixed and severe contracture requires extensive softtissue release which may create an unstable knee. The sudden stretching of posterior structures, namely the popliteal vessels, the tibial and common peroneal nerves can result in disastrous complications including thrombosis of the popliteal artery and nerve palsy.

These may worsen the pre existent disability or even lead to gangrene of the limb resulting in amputation. Less serious contractures can be treated by noninvasive measures like plaster casts or dynamic orthoses. The fractioned changing of the cast or orthosis exerts a traction stimulation on the shortened tissues that leads at first to a stretching of these tissues and eventually to tissue growth. The force of the plaster casts or orthoses, however, is limited by the pressure tolerance of the skin.[3]

The Ilizarov technique is an improvement on conventional methods. It allows progressive correction of the most complex deformities of the knee, with simultaneous correction of associated foot deformities and limb

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lengthening.[2] The principle of the Ilizarov method is he exertion of a continuous traction on bones and soft tissue that is increased in small measures, thus stimulating growth of all tissue types involved. The fixators used are distinguished by their gentleness concerning periosteal circulation and the soft tissues. The growth of bones and soft tissue during distraction treatment constitutes the principle of treatment for bone and tissue defects, marked joint contractures, and axial deviations. In severe flexion contractures of the knee joint, gradual correction can be achieved by a fixator instead of a cast, which eliminates the complications linked to casts or orthoses. The gradual and continuous correction according to the Ilizarov method not only induces a stretching but a real growth of the shortened soft tissues. Study objectives were to see the effectiveness of the Ilizarov method in the management of fixed flexion deformities of the knee joint and to identify the various associated complications.

MATERIAL AND METHODS

It is a combined retrospective and prospective study. All patients suffering from fixed flexion deformity of the knee, admitted in orthopaedic wards of M S Ramaiah Medical Teaching Hospital, and M S Ramaiah Memorial Hospital between June 2006 and December 2007 who were operated upon by the Ilizarov External Fixation for the same were the subjects of the study in the prospective group. Ethical clearance has been obtained from the ethical clearance committee of M S Ramaiah Medical College.

The subjects were assessed clinically based on history and physical examination. Radiologic evaluation using plain antero- posterior and true lateral radiographs of the involved knee was done. Patients were followed up clinically for a minimum of six months after completion of treatment. In the retrospective group, data was retrieved from hospital and department records, and also patients were evaluated during follow- up for assessing results.

Inclusion criteria

All patients with fixed flexion deformities of the knee joint who were treated by Ilizarov External Fixation.

Exclusion criteria

All patients with fixed flexion deformities of the knee for whom other modalities of treatment was performed.

Radiological evaluation

1. True antero- posterior radiographs of the affected knee joint, including the distal half of femur and the proximal half of tibia- to identify any associated varus or valgus deformity.
2. True lateral radiographs of the affected knee joint in maximum extension possible, including the distal half of femur and the proximal half of tibia- to know the amount of fixed flexion deformity of the knee and to identify any posterior subluxation of tibia.
3. Follow up radiographs were also taken similarly. Routine laboratory evaluation was done for pre operative evaluation of all the patients.

Pre operative planning

All patients were evaluated by a detailed history and clinical examination, to identify the aetiology, and their current status regarding ambulation, and the activities of daily living. An assessment of all the deformities was made along with a detailed neurological status, both sensory and motor. Muscle power was graded according to the MRC grading (Medical Research Council) from 0 to 5 (0= no contraction; 1= flicker of activity; 2= contractions and full movements with gravity eliminated; 3= contractions and full movements against gravity; 4= contractions against some resistance; 5= normal power)

Surgical technique

Pre operative apparatus preparation: Based on clinical and radiological criteria, the size of the rings with its type, material etc. are selected. E.g. steel/ aluminum/ carbon fibre; half/ / full. The sizes of the rings are measured clinically by leaving two finger breaths between the limb and the ring all round its circumference. Four rings are then assembled pre operatively. (16, 18) They are labeled R1, R2, R3 and R4 from proximal to distal. R1 is a full ring for the proximal femur; R2 is a 5/8 ring for the femoral condyles; R3 is a 5/8 ring for the tibial condyles; R4 is a full ring for the distal tibia. R1 and R2 are connected by four threaded rods. The lengths of the rods are selected by clinical measurement.

Two rods connect the last holes on either side of the 5/8 R2 to R1 while two rods are placed anteriorly. R3 and R4 are similarly connected. R2 and R3 are now connected with each other using two hinges on either side.Each hinge is constructed using a one holed male post for R2 and a one holed female post with a threaded rod attached for R3. The rings are then autoclaved for the surgery.

Surgical procedure

The procedure is performed under appropriate anaesthesia, using sterile precautions and antibiotic prophylaxis. Ilizarov wires are first passed through the femoral condyle, through the proximal tibia and through the distal tibia. For the R1 ring, one Ilizarov wire or a half pin is used. These are known as reference wires as they allow for the best (usually central) placement of the limb with respect to the apparatus. This placement is checked at the insertion of every wire from the first wire insertion and adjustments are made till we are satisfied that the limb is exactly as required in the centre or slightly anterior with respect to the centre of the rings. All wires are fixed to the rings with wire fixation bolts and tensioned. [4]

The second proximal tibial wire is passed through the head of fibula to transfix it and to avoid damaging the common peroneal nerve. All the wires are parallel to the axes of the knee and ankle joints. The Ilizarov wires are placed using the electric or pneumatic drill. Once the location of the wire is decided, it is kept aligned to the ring and a ring hole throughout the drilling process with a wire fixation bolt held by hand. After puncturing the skin and muscle, the centre of the bone is sought by feeling the bone with the tip of the wire. The bone is then drilled through and the Ilizarov wire

emerges out on the opposite side.

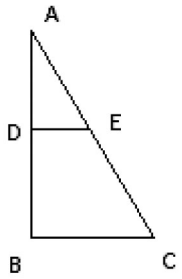
The wire should be aimed on the same side of the ring as it started (proximal or distal) and lie opposite a vacant hole. The wire is then secured to the ring with a wire fixation bolt. (16) Shanz or half pins are inserted after first making a stab incision through the skin reaching till the bone, at the pre determined site. Using a 3 mm drill, a hole is made in the centre of the bone. The shanz pin is then inserted with a hand drill till both cortices are passed. The pin is fixed to the ring using "Rencho cubes" and bolts.

Because of the thick muscle cover, the position of the femoral vessels and the sciaticnerve, using Ilizarov wires to transfix the femoral diaphysis is difficult. Hence R1 is usually fixed with 1 Ilizarov wire and two half pins or with 3 half pins only. After fixation, the two hinges are carefully positioned such that the axis of the hinges matches the instant centre of rotation of the knee joint at that degree of flexion, as far as permitted by the fixator. One or two distraction rods are fixed posteriorly between R1 and R4. If a single rod is used, it is positioned to lie directly behind the centre of the knee joint and perpendicular to the axis of the knee joint; while if two rods are used, they are placed posteriorly almost equidistant from the centre to form posteromedial and posterolateral distraction rods which provides more stability.

In case limb lengthening is required, the construct is modified to do so, by having an additional ring for the middle of the tibia, so that corticotomy and distraction can be done at the proximal tibial metaphysis. In case there are other deformities to be corrected, they are corrected either during the same sitting or at a later date. If the deformities are such that Ilizarov method is appropriate, then the frame is altered accordingly. E. g. calcaneal U plate and a half ring for the forefoot for correction of associated equinovarus deformity.

Post operative protocol

1. Radiological assessment using antero posterior and lateral radiographs of the knee with femur and tibia is made to see the FFD knee with the fixator and its components, to identify the position of the Ilizarov wires and shanz pins, and to identify the axes of the rings.
2. Arthrodiastasis is started once the operative pain is minimal, usually between the 2nd and 5th days post operative, by distraction across fixed or locked hinges between R2 and R3and the posterior distraction rod. I.e. between all three rods connecting the femur and tibia which facilitates distraction of the whole tibia with respect to the femur. This is to separate the tibial condyles from the femoral condyles to avoid pressure-induced injury of the joint cartilage when correcting the FFD knee. [4]
3. After 5 to 10 days of arthrodiastasis, adequacy of the diastasis is confirmed by a lateral radiograph of the knee joint.
4. Then the hinges are loosened and gradual distraction using the posterior distraction rod is performed daily in one to four installments. The rate of distraction was determined by the law of similar triangles as follows, aiming at of 1° per day at the knee joint, or based on patient tolerance.
5. The law of similar triangles: The target daily distraction rate should be 1 mm per day at the posterior capsule of the knee joint. The distraction rate at the posterior distraction rod is calculated from the quotient of the distances between the lengthening system and the hinge and between the concave bone side and the hinge. (17) The law of similar triangles states that if two triangles ABC and ADE are similar (i.e. all the three angles are of equal magnitude), then = . Hence, BC = Following the same principles in this figure, BC = . If DE is the distraction per day at the level of the posterior capsule of the knee joint and equals 1 mm per day; then BC, which is the amount of distraction per day at the level of the distraction rod, is or simply. Here AB is the distance from the hinge to the distraction rod and AD is the distance from the hinge to the posterior capsule of the knee joint.



6. As the deformity got corrected, the position of the hinges was periodically shifted anteriorly if possible, in the wards itself, so as to correspond with the instant centre of rotation of the knee joint. (16)
7. Distraction rods were changed when the end of the rod was reached during distraction or in case of bending of the rod.
8. In case a varus or valgus deformity developed, the distraction rod was shifted medially or laterally to correctly match the axis of the knee joint.
9. Throughout this period, the neurovascular status of the patient was assessed. Distraction was slowed or stopped in case of severe pain, or in case of development of any neurovascular complications.
10. After complete correction was achieved, the hinges were locked in position and the fixator was retained for a further three to six weeks to decrease the rebound phenomenon (Consolidation phase).
11. The fixator was then removed under anaesthesia and an above- knee POP cast applied for a further two to four weeks.
12. Then the cast was removed and the appropriate orthosis (KAFO or HKAFO) was applied. Mobilization of the knee was continued along with gait training.
13. For most of the patients, depending on tolerance, knee mobilization was done with the fixator in situ itself so as to improve the final arc of motion. This was done by disconnecting the hinges and the distraction rod.
14. Throughout the duration of external fixation, pin tracts

were kept clean with betadine.

15. For patients with resistant pin tract infection, loosening of pins, or excess pain from pin due to traction, the pins were removed, tracts debrided and replaced with a fresh pin at a different location.
16. Associate deformities were corrected simultaneously or sequentially by distraction at appropriate rods.
17. Limb lengthening, if required was performed after complete deformity correction to decrease the risk of deformity of the regenerate.

Patients were followed up for a minimum period of 6 months after removal of the fixator. During each follow up, the patients were assessed clinically with regards to recurrence of deformity, ambulation status, activities of daily living and patient satisfaction. Radiological assessment was done to measure the deformity and to identify posterior translation of the tibia.The presence of any complications was also looked for.

RESULTS

Forty nine patients with a total of fifty nine knees were included in the study.

There were 27 males and 22 females. The age at primary surgery ranged from 4 to 24. years with an average of 16.5 years and a standard deviation of 5.395. The side involvement was as follows: left side only- 22, right side only- 17 and 10 patients had bilateral involvement (table-1).

The diagnosis was Post Polio Residual Paralysis (PPRP) in 38 patients, Polio like illness in 1 patient, Multiple Congenital Contractures (MCC) [Arthrogryposis Multiplex Congenita (AMC)] in 3 patients, meningomyelocoele in 2 patients, Proximal Focal Femoral Deficiency who developed FFD knee during femoral lengthening in 1 patient, Post Septic arthritis in 2 and Post Traumatic in 2 patients.

The severity of the Fixed Flexion Deformity of the Knee ranged from 10° to 150°, with an average of 71° and an SD of 30.354. The true shortening of the limb was from 0 cm to 10 cm, with an average of 2.5 cm and an SD of 2.88. Of these, 8 patients who required limb lengthening had shortening ranging from 3 cm to 10 cm with an average of 7.5 cm (table-2).

The indication for application of the Ilizarov External Fixator was severe deformity alone in 40 knees, FFD knee with shortening in 8 knees, associated genu valgum in 1 knee, severe scarring in 1 knee, MCC in 2 knees, development of FFD knee during equinus correction by Ilizarov method in 1, meningomyelocoele with insensate limb precluding bony surgery in 3 knees, and recurrence of FFD following recurvatum osteotomy in 3 knees, including 1 with non union at the osteotomy (figure-2).

Three patients developed recurrence of the deformity more than 20° which precluded walking. All 3 had bilateral severe deformities and developed recurrence on one side. One patient was suffering from PPRP, one from meningomyelocoele and one had post traumatic FFD. Of the three, two underwent reapplication of Ilizarov All the recurrences occurred within 8 months of IEF removal. There were no recurrences noted after that (table-3).

10 patients had a hand to knee gait pre operatively. Ilizarov

Variable	Number of patients	Percentage
< 5 years	2	4.2
6-10 yrs	5	10.2
11-15 yrs	12	24.5
16-20 yrs	16	32.6
21 and more	14	28.5
Total	49	
Gender		
Male	22	44.8
Female	27	55.2
Side involvement		
Left	22	45
Right	17	34.6
Bilateral	10	20.4

Table-1: Demographic details

Pre operative FFD in degrees		
10.-30	11	22.4
31-60	10	20.4
61-100	33	67.3
>100	5	10.2
Pre operative true shortening in Cms		
0	23	47
1.-5	26	55
6.-10	10	20.4

Table-2: Pre operative Fixed Flexion Deformity and true shortening

Recurrence of deformity	Number	percentage
No recurrence	36	73.4
<20	8	16.3
>20	3	6.1
Removal before complete correction	2	4.1
Total recurrecnes	13/49	26.5
Recurrences who required repeat surgery	4./49	8.1

Table-3: Recurrence of deformity in study

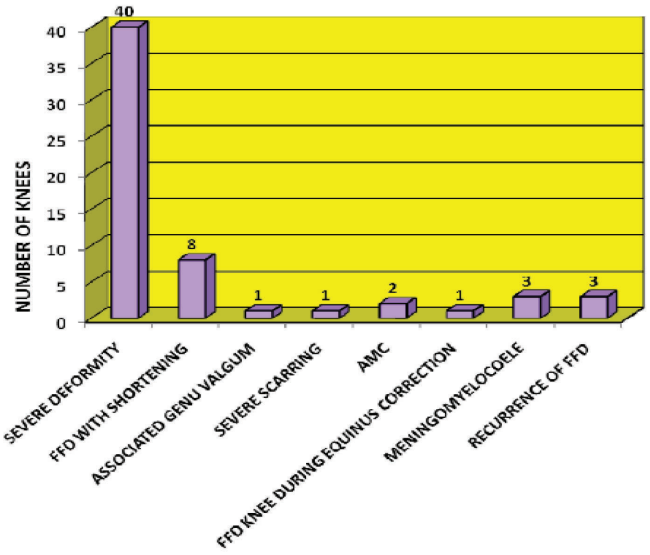


Figure-1: Indication for Ilizarov External Fixation

Pre operative gait	No.	Post operative gait	No.
Non ambulant	2	wheel chair	2
Quadriped gait	17	B/L KAFO	11
		KAFo+ AFO	4
		wheel chair	2
Walking with support	20	KAFO	18
		wheel chair	1
		PWB with crutchers	1
Hand to knee gait	10	KAFO	8
		AFO	2

Table-4: Pre and post operative Gait pattern in study

Pre operative terminal arc of motion	number	Post operative gait	number
10°-30°	8	No loss	3
		5	2
		10	2
		on IEF	1
31°-70°	29	No loss	9
		<10	10
		11.-20	7
		21-60	2
		on IEF	1
71°-140°	22	No loss	1
		<10	8
		11.-20	7
		21-60	6

Table-5: Pre and post operative terminal arc of motion in study

Complications	Number	Percentage
Pin tract infections	45	76
Wire loosening	6	10
Cellulitis, fever	4	6.7
Skin necrosis	1	1.6
Septic arthritis	0	0
Chronic osteomylitis	0	0
Posterior sublaxation of tibia	15	25.4
Strss fractures	9	15.2
Progressive equinus	8	13.5
Impingement of fixator on skin	4	6.7
Excess arthrodiastasis	4	6.7
Wire cut out	3	5
Knee pain, swelling	3	5
Decubitus ulcers	2	3.3
External rotation deformity of knee	2	3.3
Neurapraxia	2	3.3
Gangrene of toes	2	3.3
Wire breakage	1	1.6
Fracture after IEF removal	1	1.6

Table-6: Complications in study

External Fixator was applied to sequentially correct FFD knee and shortening in 5, recurrence of FFD knee following recurvatum osteotomy in 2, recurrence of FFD with non union of recurvatum osteotomy site in 1, development of FFD knee during equinus correction by IEF and severe deformity in 1 patient. After fixator removal, 2 patients are walking with AFO only while the remaining 8 are walking with KAFO (table-4).

The pre operative terminal arc of motion ranged from10° to 140° with an average of 67°. Following the correction of the deformity, the terminal arc of motion at latest follow up ranged from 10° to 120° with an average of 53.7°. There were no patients with an increase in terminal arc of motion. 13 patients had a terminal arc of motion equal to the pre operative values. The number of patients with a follow up terminal arc of motion that were within 10° of the pre operative values were 22, a loss of TAM of 11- 20° was seen in 14 patients. Another 8 patients had a loss of TAM of more than 20° with a maximum loss of 60° seen in 2 patients (table-5).

Out of 59 limbs for which Ilizarov External Fixator was applied, 45 (76%) of them developed pin tract infection. This infection ranged from minimal discharge requiring no treatment except for regular dressings in 6 patients to cellulitis with fever in 4 patients (6.77%). These patients were managed by intravenous antibiotics and pin change. The commonly infected pins were the Shanz pins at R1 level where there was movement between the skin and the pin, or the olive wires (table-6).

DISCUSSION

Fixed Flexion Deformities of the knee joint cause great disability and are impediments to efficient walking. Severe deformities may result in a quadriped gait or a non ambulant victim. The management of severe deformities has been a challenge over the years. The Ilizarov technique is an improvement on conventional methods. It allows progressive correction of the most complex deformities of the knee, with simultaneous correction of associated foot deformities and limb lengthening.[2] We compared our study with other similar studies and made the following observations.

Demographic profile

Damsin JP and Ghanem I [4] used the Ilizarov technique for correction of severe flexion deformity of the knee in 11 patients (13 knees). There were six boys and five girls with a mean age at operation of 12 years (1.7 to 18.8). The flexion contracture exceeded 90° (90 to 150) in all. The diagnosis was congenital absence of the fibula in 1, popliteal angioma in 2, myelomeningocele in 2, myelomeningocele + quadriceps aplasia in 1, multiple pterygium syndrome in 1 (bil), complex knee malformation in 1 (bil), juvenile rheumatoid arthritis in 1, Poliomyelitis in 1 and electrical amputation of the leg in 1. Pathania et al, in their study used the Ilizarov method on 8 knees. The flexion contracture varied from 60 to 100 degrees. In their series, the diagnosis was below knee amputation in 3, post traumatic contracture in 2, post polio residual paralysis in 2, post tubercular contracture of knee in 1. In our study, we had 49 patients (59 knees) for whom the Ilizarov method was used for deformity correction. There were 27 males and 22 females, the age at primary surgery ranged from 4 to 24 years with an average of 16.5 years. The severity of the Fixed Flexion Deformity of the Knee ranged from 10° to 150°, with an average of 71°. In our series, the

commonest diagnosis was post polio residual paralysis in 38 patients, polio like illness in 1 patient, multiple congenital contractures in 3 patients, meningomyelocoele in 2 patients, proximal focal femoral deficiency who developed FFD knee during femoral lengthening in 1 patient, post septic arthritis in 2 and post traumatic in 2 patients.

Mode of correction

Damsin and Ghanem[4] in their study corrected the deformity by gradual distraction in 12 knees and by supracondylar recurvatum osteotomy in 1 patient. They corrected the deformity to an average of 6.5° (0-20°) followed by application of a POP cast followed later by a permanent KAFO. At the end of correction of the flexion deformity, five knees were arthrodesed, using femorotibial compression. Pathania et al corrected the FFD by gradual distraction in all of their 8 cases to 10-15° of flexion followed by application of KAFO. No knees were arthrodesed.

In our study, we corrected the FFD knee by gradual distraction in the majority of patients (51 knees), by supracondylar recurvatum osteotomy in 7 patients and supracondylar corticotomy in 1 patient who underwent differential distraction to simultaneously correct FFD knee and achieve limb length equality. The deformity was corrected till complete correction 0° FFD followed by a consolidation period of 3-6 weeks. After removal of the fixator, an above knee POP cast was applied for a further 2-4 weeks before application of a KAFO. We did not perform knee arthrodesis for any of our patients.

Damsin and Ghanem[4] followed up their patients for an average of 4.1 years. Average fixation time was 3 ½ months (8 weeks to 1 year) and they had a recurrence of the deformity of 30° or less in 4 patients (30.76%), all of whom were operated. However, all their patients were able to walk with a KAFO. The complications in their series were mild varus in 1 (7.69%), 6 cases (46.15%) of posterior of subluxation of tibia, pin tract infection in 5 (38.46%), common peroneal nerve palsy in 1 (7.69%), and 4 fractures (30.76%). 5 patients had a mobile knee with a TAM of 5-50°. Pathania et al[1] had a follow up of 1 year, had a recurrence in 4 patients (50%) all of whom were able to walk with orthotic support. Average fixation time was 14 to 22 weeks (Average: 18 weeks). There was posterior subluxation of tibia in 1 patient (12.5%) and pin tract infection in 75%.

In our study, we had a follow up averaging 20 months. The duration of Ilizarov External Fixation averaged 7 months, with a range from 2- 24 months. There was recurrence in 13 patients (22.03%) of which 4 patients (6.77%) had to be operated upon. Of these, 9 patients were able to walk in spite of residual FFD. The complications noted were pin tract infection in 45 patients (76%), wire loosening in 6 (10.1%), cellulitis and fever in 4 (6.77%), skin necrosis in 1 (1.6%), fractures in 9 (15.25%), wire cut out or breakage in 4 (6.77%), decubitus ulcers in 2 (3.38%), posterior subluxation of tibia in 15 (25.42%), excess arthrodiastasis in 4 (6.77%), external rotation deformity at knee in 2 (3.38%), impingement of fixator on skin in 4 (6.77%), progressive equinus in 8(13.55%), gangrene of tips of toes in 2 (3.38%) and neurapraxia in 2 (3.38%). The post operative TAM ranged from 10° to 120° with an average of 53.7°. [5,6,7]

Haung reported on his series of ten patients with fixed flexion deformity of the knee. There was 80% recurrence in his study, and posterior subluxation of tibia in 30%. In our study, there were 49 patients and the recurrence rate was 22.03% with posterior subluxation of tibia in 25.42%. [8]

The Ilizarov technique is an improvement on conservative methods. It allows progressive correction of the most complex deformities of the knee (Damsin and Carlioz)[4], with simultaneous correction of associated foot deformities and limb lengthening. Nevertheless, rigorous application of the basic principles is mandatory (Plawecki; Merloz; Paley; Bell, Boyer and Armstrong; Damsin and Carlioz).[9,10,11,12,1] A minimum of three Ilizarov femoral and tibial pins, in two different planes, is essential (Bianchi-Maiocchi et al)[13].

CONCLUSION

Ilizarov External Fixation is an excellent method of treatment of severe fixed flexion deformities of the knee. Failed previous surgeries, multiple deformities of the lower limb can be effectively treated with a single apparatus and limb lengthening can also be performed by this versatile technique.Non ambulant patients who have never walked in their lives can ambulate independently. The recurrence rates are acceptable.

Complications such as pin tract infections, stress fractures, posterior subluxation of tibia and progressive equinus can be anticipated and prevented. These can also be effectively treated by the Ilizarov method. In view of the immense benefits of the Ilizarov method, this should be the recommended method in the correction of severe fixed flexion deformities of the knee, correction of multiple and complex limb deformities and when other methods have failed, in spite of the associated complications.

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