



Ctev And Other Deformities Treated By Ilizarov And Jess Fixators

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Abstract

Background: The incidences of neglected, recurrent/relapse and rigid feet were common in Indian scenario because of low socioeconomic status, ignorance and lack of opportunity. **Objectives:** To explore the role of external fixators (Ilizarov and Joshi external stabilisation system) in correcting cases of club foot peculiar to India. **Materials and methods:** Between September 1995 to March 2005, 33 feet in 22 patients with neglected or relapsed (recurrent) club foot deformities treated by external fixators (Ilizarov and JESS). There were 16 (73%) males and 6 (27%) were females; age was ranging 7 months to 15 years with an average of 5.9 years. 14 patients with 22 (67%) feet were of neglected type and 8 patients with 11 (33%) feet were of recurrent/relapsed type. Unilateral and bilateral were in equal number. Clinical assessment was done using Carroll's criteria. Total of 13 feet were treated by Ilizarov external fixators and 20 feet were treated by JESS external fixators. Out of 33 feet, 14 (42.4%) underwent previous procedure, the average preoperative talocalcaneal index was 32 degrees and postoperative was 48 degrees. **Results:** Patients were followed up for an average of 3.1 years (6 months to 8 years), the fixator period was 23.6 weeks in patients treated with Ilizarov and 13.6 weeks in JESS. The following complications were encountered, temporary edema noted in 4 feet, superficial pin tract infection in 8 feet, skin necrosis in 1 foot, loosening of pins in 4 feet, rocker bottom foot in 1 foot, hematoma formation in 1 foot, flexion contracture of toes in 14, osteomyelitis of tibia in 1 patient. Results were evaluated using the hospital for joint diseases. Orthopaedic institute functional rating system for clubfoot was used and it showed 6 (18.2%) excellent, 21 (63.6%) good, 4 (12.1%) fair and 2 (6.1%) poor. The results correlated with age of the patient and the severity of the deformity. Our results were comparable with published results of C F Bradish et al 1991, Oganessian and Istomina 1991 and Suresh et al 1999. **Conclusion:** Treatment by external fixator with Ilizarov external fixator and JESS is thus a very good method of treatment for difficult club feet.

Keywords: Club foot, external fixator, CTEV, Ilizarov, JESS



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INTRODUCTION

One of the most common congenital deformities of foot is idiopathic clubfoot. The treatment of clubfoot can be conservative or surgical. Nearly half of the feet do not show full correction with conservative management during early period. There are numerous surgical procedures described for correction of clubfoot like posteromedial release of Turco, Mukhopadhyay procedure with its variants and circumferential release as described by McKay, Carroll and Simmons etc. and more

The treatment of relapsed, neglected and rigid varieties of clubfoot is usually based on corrective operation in the hind foot by posteromedial release, equinus by tendo achilles lengthening and correction of varus heel by calcaneal osteotomy (Dwyer 199-69) and also few other bony procedures. Since the aim of the treatment is to balance the discrepancy in the length between the lateral and medial side of the foot, external fixator methods by doing differential distraction of medial and lateral sides came into force. Ilizarov external fixator system helped in treating these cases with differential distraction methods and is being widely used all over. One simpler versatile and light fixator system was developed by Dr. B.B. Joshi and it was proved successful in almost of all age groups ranging from 4 months to 19 years which involved a method of controlled, differential distraction. The aim of our study is to assess the efficacy of differential distraction as a method of treatment of club foot, to find out its applicability in relapsed and neglected clubfoot, to assess the results based on functional and clinical criteria and to evaluate various merits and demerits of differential distraction method.

MATERIALS AND METHODS

This study includes treatment of 33 feet in 22 patients with neglected or relapsed recurrent clubfoot deformities by external fixators (Ilizarov and JESS) from September 1995 to March 2005 in MS Ramaiah medical college hospital, Bangalore.

Inclusion criteria: Age 6 months to 15 years, relapsed/recurrent/rigid/neglected cases of clubfeet

Exclusion criteria: Clubfoot in less than 6 months old, paralytic clubfoot.

The patients were then assessed clinically using Carroll's assessment. Radiographs of ankle and foot AP, lateral and stress dorsiflexion views were taken. The following angles were calculated: Talo calcaneal angle in AP and stress dorsiflexion view, talo first metatarsal angle in AP view, Tibio calcaneal angle in lateral view and Talo calcaneal index.

The proximal and distal tibial block was made with ilizarov ring construct. The distal tibial block is connected to hindfoot block by hinges and forefoot block connected to hindfoot block by hinges and it corrects heel varus. Tibial block connected to forefoot by anterolateral rod and distraction corrects equinus deformity.

Deformity of forefoot was corrected simultaneously by adjusting the two connecting rods 1mm daily by differential distraction. Adduction can be corrected by additional rods were added to connect the hind foot and forefoot half rings. This was achieved by lengthening the medial rod at the rate of 1mm per day or lateral rod at 0.3mm daily.

JESS fixator

The patients were operated and followed by Dr. B.B.Joshi method of controlled differential distraction. In tibia 2 parallel transfixing wires were passed in the tibia, perpendicular to the longitudinal axis of from lateral to medial. The length of the middle segment of the Z bar is marked below the first wire. The second wire was passed parallel to the first wire at this level. While passing the metatarsal wires the surgeon must hold the foot with one hand drill the wires. 2 transfixing parallel wires are passed into the tuber of the calcaneum from medial side. Axial calcaneal wire also passed. The attachment of Z and L rods was also done. The metatarsal and calcaneal attachments done.

Review of literature

Hippocrates gave the first authentic description of club foot as there is more than one variety of clubfoot. He thought that anomalous muscle maintains the deformity¹. Antonio Scarpa published his memoir on congenital clubfoot on 1803.¹W.J.Little in 1839 managed the deformity by tendoachilles tenotomy². In 1884, William Adams published his monograph on club foot, its cause, pathology and treatment.³ He recognised hereditary basis of the deformity. He was convinced that there were changes in talus^{3,4}. Bohm in 1935 proposed that germ plasm defect can be responsible for clubfoot deformity⁵. Brockman in 1937 believed the deformity was due to congenital subluxation of talonavicular joint following aplasia of the joint⁶. In 1939, kite presented paper on his experience of conservative management of clubfoot by series of plaster casts⁷. Ignacio ponsetti in 1963 treated 322 patients with the clubfoot deformity. The deformity was corrected by manipulation and application of plaster casts⁸.

RESULTS

The present study includes treatment of 33 feet in 22 patients with neglected, relapsed and rigid foot treated by external fixator (ilizarov and JESS) from September 1995 to March 2005.

Sex distribution

Out of 22 patients, 16 (72.7%) were male and 6 (27.3%) were female showing male preponderance

Side distribution

There were 11 unilateral and 11 bilateral patients. There were 17(51.5%) right sided and 16(48.5%) were left sided.

Type of clubfoot

There were 14 patients with 22(66.6%) feet were of neglected type and 8 patients with 11(33.4%) feet were of recurrent or relapsed type.

Type of fixators

8 patients (36.3%) with 3 unilateral and 5 bilateral (total of 13 feet) were treated by ilizarov external fixator and 14 (63.7%) patients with 8 unilateral and 6 bilateral (total of 20 feet) were treated by JESS external fixators.

Previous procedures in relapsed/recurrent club foot

Out of 33 feet, 14 (42.4%) underwent previous procedures, 2 manipulation and serial casting, 8 soft tissue release and 4 underwent both manipulation, serial casting and soft tissue release.

Table 1: Previous procedures in relapsed/recurrent club foot

Serial. no	Previous procedures	No of feet
1	Manipulation and serial casting	2
2	PMSTR and TA lengthening	8
3	Both 1 & 2	4
4	Total	14

Table 2: Radiological correction

Pre operative			Post operative		
Average Talocalcaneal angle		Average Talocalcaneal index	Average Talocalcaneal angle		Average Talocalcaneal index
AP	Lateral	32	AP	Lateral	48
14	18		20	28	

Average preoperative TC index was <40 degrees and the Average postoperative TC index >40 degrees and it indicates average radiological correction

Complications following treatment

In our study, the following complications were encountered. The temporary edema was noted in 4 feet, treated by elevation of foot and temporary cessation of distraction. The superficial pin tract infection in 8 feet, treated with regular dressing and antibiotics. Skin necrosis in 1 foot on the medial border of the foot, treated with dressings and temporary cessation of distraction. The loosening of pins was seen in 1 foot which was corrected by loosening and allowing the foot to fall back to equinus and applying thrust force and gradually corrected by kite's principles. The hematoma formation in 1 foot on the medial border of sole treated by evacuation, but was later diagnosed as haemophilia and treated for that. However, he later developed heel infection and fixator was removed prior to achievement of full correction. Flexion contracture of toes noted in most of our cases and was treated by foot plate/k wire fixation to toes. Osteomyelitis of tibia was seen in 1 foot and was treated with curettage, antibiotics and regular dressings.

Follow up period

The average follow up period was 3.1 years for JESS patients and 3.2 year in patients treated with Ilizarov method.

Table 3: Follow up period

Follow up period	JESS patients	Ilizarov patients
6 months to 1 year	5	3
1 year to 2 years	3	2
2.1 to 4 years	3	1
4.1 to 6 years	2	1
6.1 to 8 years	1	1

Results according to Lehman, Atar et al. functional rating system

Out of 33 feet treated by Ilizarov/ JESS combined, it showed 6 (18.2%) excellent, 21(63.6%) good, 4 (12.1%) fair and 2 (6.1%) poor. Of 13 feet treated by Ilizarov, 2 (15.4%) were excellent, 7 (53.8%) were good, 3 (23.2%) were fair and 1 (7.6%) was poor. Of 20 feet treated by JESS, 4(20%) were excellent, 14(70%) were good, 1(%) was fair and 1 (%) was poor. Results were better in patients treated by JESS compared with the Ilizarov because of younger age group and less severe deformity.

Distribution of final results with respect to type of clubfoot

Of the 22 neglected club feet 2(9%) were excellent, 15(68.2%) were good, 3(13.6%) were fair and 2(9%) were poor. Of the 11 relapsed/recurrent/rigid clubfeet, 4(36.4%) were excellent, 6(54.5%) were good and 1(9%) was fair.

Fixator period

The average time for fixator removal in patients treated by Ilizarov was 23.6 weeks. In JESS, it was 13.6 weeks showing the more need for time for differential distraction in Ilizarov.

DICUSSION

External fixators offer a versatile method of correcting complex 3 dimensional deformities of the foot such as clubfoot more so with rigid, deformed and previously operated cases.

The physiological tension and stress applied to the tissues stimulate histoneogenesis, while controlled differential distraction gradually corrects the deformities and realigns the bones. The results in our study were compared with other series and showed good results.

Comparison of age, sex and laterality

In Suresh et al.¹² 1999, 44 feet with male predominance were studied. In it unilateral were more with age ranging from 0.8 to 6 years. There were more of younger age group in the study with most of them were less than 3 years. In Ogenesian and Istomina¹³ – 1991 studied 70 feet, with male predominating and unilateral more than bilateral cases with average age of 12 years. In our study there were 33 feet with male predominance, with age ranging from 0.7 to 15 years and unilateral and bilateral were same. Majority of the patients were less than 6 years.

Table 4: Comparison of age, sex and laterality

Series (year)	No of feet	Age in years	Sex		Laterality	
S. Suresh et al 1999 ¹²	44	0.8-6	30	14	8	18
Ogenesian and istomina – 1991 ¹³	70	12	37	19	42	14
C.F. Bradish et al. 1999 ¹⁴	17	6-11	7	5	7	5
Our study	33	0.7-15	16	6	11	11

Comparison of type of club foot, duration of external fixator in weeks

In Suresh et al.¹² there were 45% neglected, 55% recurrent/relapsed type with average follow up of 2.2 to 3.9 years. In Ogenesian and Istomina – 1991¹³ there were 70 feet treated by hinged distraction device; average fixator period was 16 weeks with follow up ranging from 1-9 years. In our study, there were more of neglected type, 22(66.6%) compared to recurrent/relapsed 11(33.4%). The average fixator period was 17.6 weeks. In the patients treated by ilizarov was 23.6 weeks and in JESS it was 13.6 weeks. The average follow up was 3.1 years ranging from 6 months to 8 years.

Table 5: Comparison of type of club foot, duration of external fixator in weeks

Series	No of feet	Type of club foot		Duration of external fixator in weeks	Average follow up in years
		Neglected	Recurrent/relapsed		
S. Suresh et al 1999 ¹²	44	22(45%)	24(55%)	13.4 (6-24 weeks)	2.2-3.9
Ogenesian and istomina – 1991 ¹³	70	No data	No data	16 weeks	1-9
C.F. Bradish et al. 1999 ¹⁴	17	0	17	12 weeks	2.5
Our study	33	22(66.6%)	11(33.4%)	17.6 weeks	3.1

Radiological assessment was done using talo calcaneal index and it was compared with other series showed good radiological correction

Table 6: Radiological Assessment

Series	Average Preoperative			Post operative		
	TC AP	TC Lateral	TC index	TC AP	TC Lateral	TC index
Graham and dent et al	-	-	-	25 ⁰	20 ⁰	45
Lau et al	-	-	-	16 ⁰	22 ⁰	38
Stromquist et al	-	-	-	15 ⁰	24 ⁰	39
Ryoppy and Sauomen et al	-	-	-	26 ⁰	30 ⁰	56
Our study	14 ⁰	18 ⁰	32	20 ⁰	28 ⁰	48

Complications following treatment

In Suresh et al.¹². 1999, of 44 feet treated by jess there were 12(27.3%) pin tract infections, 2 (4.5%) skin necrosis, 6 (13.6%) pin loosening, 1 foot (2.2%) with flexion contracture of toes and the fixator was removed in 4 (9%) because of pin

loosening. In our study, of 33 patients treated by Ilizarov and JESS there were 8 (24.2%) pin tract infections, 1(3%) skin necrosis, 4(12.2%) pin loosening and 14 (42.4%) flexion contracture of toes. Early fixator was removed in one case because of hematoma and heel infection

Results following treatment

In Suresh et al.¹² 1999, 44 feet treated by jess there were 77 % excellent, 13 good, 0 fair and 9 % poor. The results were better because of younger age. In Oganessian and Istomina¹³- 1991 treated by hinged distraction device there were 75.7% excellent, 18.5% good, 5.7% fair and no poor results. In our study, there were 18.2 % excellent, 56.6% good, 12.1% fair and 6.1% poor results. The results were better in patients treated with JESS compared to Ilizarov, because of younger age group and less severe of the deformity.

CONCLUSION

The present study was conducted to assess the outcome following the treatment of clubfoot by Ilizarov and JESS. The goal of any clubfoot surgery is to obtain a cosmetically acceptable foot, pliable, functional, painless, plantigrade foot and to spare the parent and the child from the ordeal of frequent hospitalization and years of treatment with casts and braces.

The commonest age group of presentation was below 6 years. Male were more affected (73%) than females (27%). Unilateral and bilateral were in equal number. Carroll's clinical assessment helps in complete assessment of the deformity and the score helps knowing the prognosis of the patient. Preoperative and postoperative assessment of talo calcaneal index helps in radiological assessment

Advantages of jess fixator include no operative scars and then complications, foot length can be maintained, a soft supple and a plantigrade foot can be achieved and suited for children in whom the club foot deformity remain uncorrected by cast application, manipulation and recurrent club foot

Advantages of ilizarov external fixators include the ilizarov technique achieves correction by distraction of joint allowing realignment and the soft tissue tension may also stimulate bone growth. The ilizarov technique allowed correction of the deformity without the need for an open surgery. In the equinus deformity it avoids the need for Tendoachilles lengthening, thus reducing the risk of weakening of "push off".

Surgical correction by radical techniques such as triple arthrodesis results in loss of size of the foot, which may destabilize balance of normal gait. The size of the foot can almost be maintained in patients treated by external fixators.

It is possible to treat severely deformed club foot non-invasively, without bone resection and without shortening of foot. This method allows simultaneous correction of all components of the deformity and it is not necessary to wait for the completion of skeletal growth.

Ilizarov technique should be considered as an alternative for repeated soft tissue release or correction by osteotomies.

The hospital for joint diseases orthopaedic institute functional rating system for clubfoot probably helps best in analysing the functional outcome, since it includes clinical, radiological and functional parameters. There was no recurrence of gross deformity after completion of the treatment

Patient and parent compliance is important to withstand the few treatable complications with this type of treatment. A pampered child of a desperate parent is a contraindication for such a procedure. Results were good in younger age compared to older and also based on severity of deformity.

The use of ilizarov patients younger than 3 years who have small feet presents considerable problems. In these patients small frame of jess is easier to use due to the small feet than the bigger ilizarov frame

In small feet, young child treatment with jess fixator is preferred as the frame is small and easier compared to Ilizarov, where as in older children and more resistant feet Ilizarov fixator is preferred method. But the JESS frame can still be used for all age groups.

In relatively mild and moderate varieties of club foot probably traditional soft tissue surgery still holds good.

Although the technique has a lot of advantages, one should not forget that the injudicious and unsupervised distraction may lead to catastrophic results in the small developing feet.

Treatment of clubfoot by external fixator produces excellent results with proper preoperative planning, adherence to Ilizarov and JESS principles, strict asepsis, proper postoperative treatment, rehabilitation and patient education.

Long studies (>10years) and large sample size are required to accurately assess the functional outcome of treatment of clubfoot by external fixators- Ilizarov/JESS. Thus, it concludes that external fixator application is an excellent technique

for treatment of resistant and neglected club foot. And in our series, JESS fixator gave better results since most of the patients treated by JESS were less than 6 years.

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