

## Original Research Article

# A prospective study of neglected and resistant clubfoot cases treated using Joshi's external stabilization system

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### ABSTRACT

**Background:** Clubfoot is a common congenital deformity occurring in 1 to 2 per thousand live births. In relapsed or neglected clubfoot the deformities become fixed and treatment using conservative methods often fails. JESS (Joshi's external stabilizing system) is a simple construct for the correction of deformity in these patients. The present study was taken up to assess the results of JESS fixator in correction of deformities in neglected, resistant or relapsed cases of clubfoot and deformities in the late presented patients.

**Methods:** The present study was conducted on randomly selected patients of clubfoot in the department of Orthopaedics, ESI Hospital, Basaidarapur, New Delhi between June 2014 and December 2017. A total of 22 feet (of 16 patients) suffering from neglected, resistant or relapsed clubfoot under the age of 7 years, were included in the study.

**Results:** Excellent results were obtained in 52% of cases, while 19% had good, 14.5% had fair and 14.5% had poor results. Complications encountered were temporary oedema in 10 feet, superficial pin tract infection in 5 feet, pin loosening in 3 feet, skin necrosis 2 feet and flexion contracture of toes in 2.

**Conclusions:** JESS application is an excellent technique for treatment of recurrent and neglected clubfoot. This procedure is ideally suited for children in whom the clubfoot deformities remain uncorrected by POP casts and manipulation, as well as for recurrent clubfoot cases.

**Keywords:** CTEV, Clubfoot, JESS

### INTRODUCTION

The term Talipes equino varus is derived from the Latin term Talipes – a combination of words “Talus” (ankle) and “pos” (foot), Equinus meaning “horse like” (the heel in planter flexion) and varus meaning inverted and adducted. It is a common congenital deformity occurring in 1 to 2 per thousand live births; seen more commonly in males and is bilateral in about 50% of the cases.<sup>1</sup>

The real cause of talipes equinovarus is still unknown, however there are some key factors including genetic

factor, histologic anomalies, vascular anomalies and intrauterine factor which give some clue about aetiology. Every conceivable form of treatment has been recommended for it. The 20th century has been marked by the classification of two major concepts in management of club foot. First is the principle of manipulation, strapping and serial correction plaster cast advocated by Kite and Dennis Browne and Ponsetti. Second is Soft tissue corrective surgery which is done later on for feet that do not respond to this conservative treatment. Since Turco describe Posteromedial Soft Tissue Release procedure (PMSTR), it has become the

procedure of choice for most clubfeet that need soft tissue surgical correction.<sup>2,3</sup>

In developing countries like India cases presenting late or after relapse constitute quite a major proportion. In relapsed or neglected clubfoot the deformities become fixed and the feet develops secondary adaptive bony changes. Various bony procedures in the form of osteotomies or arthrodesis have been described for these cases, however bony procedures lead to further shortening. A treatment option has emerged from bony procedures towards ring external fixator system based on the principle of Differential Fractional Distraction Histogenesis of Ilizarov.<sup>4</sup> Grill and Franke, Paley have used ilizarov fixator to correct complex three dimensional deformities of clubfoot.<sup>5,6</sup>

A simple construct for the correction of clubfoot deformities known as JESS (Joshi's External Stabilizing System), has been developed by Joshi et al of Mumbai, which can be used even in children below three years of age because it doesn't use tensioned wires. With JESS, the author has shown successful management of clubfoot deformities from the age of 3 months to adulthood.<sup>7</sup>

The present study was taken up to assess the results of JESS fixator in correction of deformities in neglected, resistant or relapsed cases of clubfoot and deformities in the late presented patients.

## METHODS

The present study was conducted on randomly selected patients of clubfoot in the department of Orthopaedics, ESI Hospital, Basaidarapur, New Delhi between June 2014 and December 2017. A total of 22 feet (of 16 patients) suffering from neglected, resistant or relapsed clubfoot were included in the study. Children with idiopathic clubfoot of neglected, resistant or relapsed type under the age of 7 years were included in the study. Children above the age of 7 years, children with neurogenic and syndromic clubfoot are excluded from the study. Microsoft office 2007 was used for the analysis. Descriptive statistics like mean and percentages were used for the analysis.

### Pre-operative workup

Pre-operative investigations, hemogram and chest X-ray were obtained as a part of pre anaesthetic checkup, and once fit for anaesthesia, were taken up for application of JESS fixator.

### Pre-operative preparation

The size of the external fixation to be used was determined pre-operatively from three sets of assembly components designed to suit the requirement of different age groups.

- Small set (suitable for children up to 2 years)
- Medium set (suitable for children between 2-5 years)
- Large set (suitable for age more than 7 years)

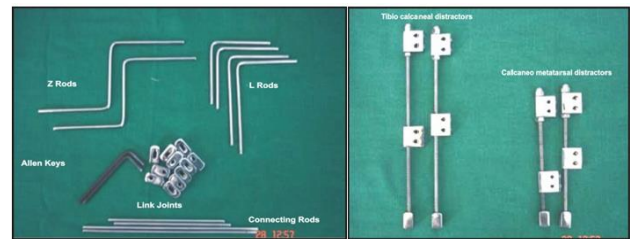


Figure 1: JESS instruments.

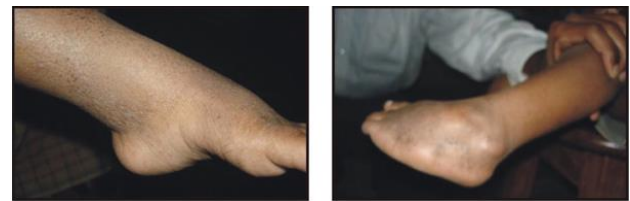


Figure 2: Preoperative (neglected CTEV).

### Operative procedure

A drill was used to insert the tibial wires and for the metatarsal and calcaneal wires a T-handle was used. The tibial wires were attached to the middle segment of the "Z" rods by link joints on the medial and lateral sides. One connecting rod was used to span the anterior limbs of the "Z" rod, which project downward, and another to span the posterior limbs projecting upwards. Two small "L" rod were attached to the metatarsal wires on medial and lateral sides of the foot with one limb projecting plantwards, and the angle of the "L" was placed distally. The planter projections were connected by a connecting rod to provide support for the footplate. Two "L" rods were attached to the transfixing calcaneal wires on either sides of the heel, in the same manner as described for the metatarsal "L" rod attachments. Behind the foot these rods were connected to each other by a connecting rod on which the axial calcaneal wire was clamped. The planter projections of the "L" rods were again connected by a connecting rod, which formed the second support for the footplate.

A pair of appropriate size distractors were attached to the calcaneal and metatarsal wires on either side of the foot keeping the distraction knobs anteriorly for easy handling during distraction.

Postoperatively, limb was kept elevated over pillows and antibiotics and analgesics were prescribed. A strict watch kept for any neurovascular complication. X-ray of leg, ankle and foot were done to confirm the placement of wires. Distraction was commenced on third postoperative day.

**Distraction schedule**

*Distraction phase:* Differential distraction on medial side was performed twice the rate than that on the lateral side. Distraction at the lateral side prevents crushing of the articular cartilage and it also permits normal growth of epiphyseal plate on lateral side. Post operatively distraction was performed as follows:

A) The calcaneo–metatarsal distraction

Medial @ 0.25 mm 6 hourly  
Lateral @ 0.25 mm 12 hourly

B) The tibio-calcaneal distraction.

Medial @ 0.25 mm every 6 hours  
Lateral @ 0.25 every 12 hours

*The static phase:* Following the correction, assembly is held in static position for further three to six weeks to allow soft tissue maturation in elongated position. The fixator was removed after about double the distraction phase under sedation. An above knee cast in full correction was given for one week.



**Figure 3: Postoperative (with JESS).**

**Post JESS removal follow up**

At one week the cast was removed and post correction A – P and lateral views X-rays were taken with the child sedated. After good quality X-rays were obtained, a below knee corrective cast was given for another 2 weeks.

At next follow up, the child was given a moulded corrective splint for night and CTEV shoes.

The child was then called for regular follow up every month on the basis of objective, subjective and radiological criteria based on Hospital for Joint Disease Orthopaedic Institute Functional Rating System for clubfoot surgeries (Lehman et al).<sup>8</sup>



**Figure 4: Postoperative (after JESS removal).**

**RESULTS**

In our study age of the patients ranged from 2-7 years with an average 3.2 years. Out of 16 patients 13 male and 3 were female patients. There were 10 unilateral and 6 bilateral cases. Out of 22, there were 8 neglected and 14 recurrent cases. The average fixator period was 11.42 weeks. The average follow up was ranging from 4-14 months. The final results were interpreted as per the Lehman’s, Atar et al, criteria. In our study there were 52% excellent, 19% good, 14.5% fair and 14.5% poor results. In our study we faced number of complications. There were 5 pin tract infections, 10 temporary edema, 3 pin loosening, 2 skin necrosis and 2 flexion contractures of toes.

**Table 1: Patient demographic data.**

	No. of cases	Percentage (%)
<b>Sex</b>		
Male	13	81.25
Female	3	18.75
Total	16	100
<b>Side affected</b>		
Unilateral	10	62.5
Bilateral	6	37.5
Total	16	100

**Table 2: Postoperative assessment.**

S. no	Category	No. feet	%
1.	Dorsiflexion 90° & above	15	68.18
2.	Subtalar motion possible	13	59.09
3.	Heel neutral/valgus.	15	68.18
4.	Forefoot neutral/abduction	12	54.54
5.	Gait normal heel to toe gait	10	45.45
6.	TC index >40°	18	81.81
	Talo I <sup>st</sup> metatarsal <10°	11	50
7.	Shoes regular without complaint	18	81.81
8.	Functions not limited	16	72.72
	Functions occasionally limited	6	27.27
9.	Pain– never	16	72.72
	Pain– occasional	6	27.27
10.	Flexor tendon function– full	19	86.36
	Flexor tendon function– partial	3	13.63

**Table 3: Complications.**

Complications	No. of feet	Percentage (%)
Oedema	10	45.45
Superficial pin tract infection	5	22.72
Pin loosening	3	13.63
Persistence of cavus & equinus deformity	2	9.09
Flexion contracture toes	2	9.09
Skin necrosis	2	9.09

## DISCUSSION

Since the time of Hippocrates (300 BC), clubfoot has remained a perplexing problem for the Orthopaedic surgeons. An exhaustive review of literature shows the Herculean effort that has gone into the causes and the methods of treatment.

In 1988 a light fixator system was developed by Joshi using Prof Ilizarov's principles. He advocated a method of controlled, differential distraction which was more physiological in comparison to any other technique. This method proved successful in almost all age groups ranging from infants to adulthood. The present study was taken up to assess the results of JESS fixator in correction of deformities in neglected, resistant or relapsed cases of clubfoot and deformities in the late presented patients

In the study conducted by Suresh, Ahmed et al 45% feet were neglected, 50% drop outs from plaster of Paris casting and 5% recurrent type, with an average follow up of 2.2 to 3.9 years.<sup>9</sup> Ogenesian and Istomina studied 70 feet treated by the Hinged distraction device, the average fixator period was 16 weeks with follow up ranging from 1-9 years.<sup>10</sup> In the study by Bradish et al, recurrent clubfeet were treated with Ilizarov fixator, with average fixator period 12 weeks with follow up ranging from 3.8 years.<sup>11</sup> In our study there were 8 neglected and 14 recurrent, the average fixator period were 11-42 weeks. The average follow up was ranging from 4-14 months.

**Table 4: Results comparison with previous studies.**

Series	Excellent (%)	Good (%)	Fair (%)	Poor (%)	Type of fixator used
Joshi et al <sup>7</sup>	68	16	8	8	JESS
Suresh, Ahmed et al <sup>9</sup>	77	13	0	9	JESS
Ogenesian and Istomina <sup>10</sup>	75.7	18.5	5.7	0	Hinged distraction device
Bradish et al <sup>11</sup>	47	29.4	11.7	11.7	Ilizarov
Marthya, Arun <sup>12</sup>	47	29.4	22.8	17.5	JESS
Present study	52	19	14.5	14.5	JESS

In the study done by Suresh, Ahmed et al of 44 feet treated by JESS there was 77% excellent, 13% good, 0 fair and 9% poor. The results were better because of younger age.<sup>9</sup> Ogenesian and Istomina concluded that in thd patients treated by Hinged distraction device there were 75.7% excellent, 18.5% good, 5.7% fair and no poor results.<sup>10</sup> In Bradish et al treated by Ilizarov device there were 47% excellent, 29.4% good, 11.7% fair and 11.7% poor results.<sup>11</sup> Mathya concluded there were 47% excellent, 24.4% good, 22.8% fair 17.5% poor results.<sup>12</sup> In Joshi et al, study, treated by JESS there were 68% excellent, 16% good, 8% fair, 8% poor results.<sup>7</sup> In our study there were 52% excellent, 19% good, 14.5% fair and 14.5% poor results.

Complications are a part of any surgical procedure. In our study also we faced a number of complications. Pain was the most common and a very significant complaint of the patients and their parents. Almost every patient (90%) complained of pain throughout the time the fixator was on. Swelling of the foot was noticed in many patients (10 patients) not only in the immediate post op period but also in the dynamic phase. This was probably due to distraction of the tissues because in none of the foot, the swelling persisted significantly in the static phase. Superficial Pin tract infection, apart from pain and

swelling, was the most common complication seen in 5 patients. Pin loosening was seen in 3 patients. Pressure sores, causing necrosis of the planter surface of toes were seen in 2 patients. Flexion contracture of the toes was another common problem seen in 2 patients.

Joshi et al in treating 16 patients with JESS encountered complications like pin tract discharge, edema, blisters on dorsum or medial side of foot. One case had developed rocker bottom foot due to over stretching.<sup>7</sup> Paley reported on 23 patients with 25 feet treated with lizarov. They had 20 complications in 18 feet. Pin tract infection occurred in at least one pin in every patient.<sup>6</sup> In Suresh, Ahmed et al of 44 feet treated by JESS there were 12 (27.3%) pin tract infections, 2 (4.5%) skin necrosis, 6 (13.6%) pin loosening, there was 1 (2.2%) foot with flexion contractures of the toes and the fixator was removed in 4 (9%) because of pin loosening.<sup>9</sup> Marthya and Arun, reported 57 feet treated 31 developed pin tract infection and 4 developed skin necrosis.<sup>12</sup>

## CONCLUSION

The goal of any clubfoot surgery is to obtain a cosmetically acceptable, pliable, functional, painless, and 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 procedure used in the current study holds promise for fulfilling the above-mentioned goals. This procedure is ideally suited for children in whom the clubfoot deformities remain uncorrected by POP casts and manipulation, as well as for recurrent clubfoot.

Fractional distraction using JESS apparatus is an easy method, which does not require any sophisticated instrumentation or image intensification. Parents learn the distraction technique easily. Pin tracks should be cared meticulously. Adequate period of static phase is necessary before removal of the apparatus. Strict postoperative management and follow up is mandatory.

Although the technique has a lot of advantages but injudicious and unsupervised distraction may lead to catastrophic results in the small developing foot.

Long term studies are required to accurately assess the functional outcome of treatment of clubfoot by JESS. Thus we conclude that JESS application is an excellent technique for treatment of recurrent and neglected clubfoot.

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