

Application of Ponseti Principle in Ilizarov Based Fixators for Treatment of Untreated and Relapsed Club Foot

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Abstract: Club foot is amongst the most common of congenital deformities. Its incidence is 1 to 2 per 1000 live births. At birth, the diagnosis can be made by observing the foot for forefoot adduction, hindfoot inversion and equinus deformity. The study was conducted to evaluate Application of Ponseti Principle in Ilizarov based fixators for treatment of untreated and relapsed Club foot. Total of 18 cases (22 feet) were studied, which were corrected by JESS. All cases were evaluated clinically, radiologically, podographically, and Pirani scoring system, both, before and after the correction. Severity of the deformities and clinical correction was assessed by Pirani score. All patients achieved good clinical results as per Pirani score, radiological evaluation showed that all subjects achieved the normal range of values.

Keywords: Club foot, Inversion, Pirani, Adduction, Neglected

1. Introduction

Club foot is among the most common of congenital deformities congenital talipes equinovarus (CTEV) is a complex three-dimensional deformity having four components-equinus, varus, adduction and cavus. The deformity continues to post many difficulties in its management. It is a hereditary foot deformity. Its incidence is 1 to 2 per 1000 live births. At birth, the diagnosis can be made by observing the foot for midfoot adduction, hindfoot inversion and equinus deformity. Lehman (1980) and Sompii (1984) classified the clubfoot as nonrigid, rigid and teratologic variety. Our aim is to eliminate or if not possible, to reduce all elements of the club foot deformity, hence, achieving a functional, pain free, normal looking plantigrade, mobile foot. The factors associated with the poor prognosis are female child, hereditary, late age of presentation, severity of deformity, rigidity of foot, associated cavus. Kite rationalized the whole treatment of clubfoot by conservative means. Satisfactory results are obtained by Ponseti and SM dey method of manipulation and serial casting. Percutaneous soft tissue release and tenotomy for getting the corrected foot had been advocated by various workers. The method of controlled differential distraction, that is, ligamentotaxis, along with the mini external fixator was originally described by Dr BB Joshi in 1990. Ilizarov fixator has also been used for correction of CTEV deformities. External fixators were used to correct difficult clubfeet by the Ponseti principle in cases of neglected and relapsed clubfoot by using an Ilizarov-based fixator to get optimum results and get plantigrade pliable foot. We considered any clubfoot presented untreated and relapsed to us for the management at or after the age of 2 year upto 7 year. This study was conducted to evaluate the clinicoradiological outcomes of neglected idiopathic CTEV managed by Application of Ponseti Principle in Ilizarov based fixators System. We, in our study, intended to use the indigenous assembly of distracters and static rods held by link joints to transfixed k-wires for correction of all the components of this deformity. This method involves controlled differential fractional distraction to correct all the aspects of central deformity by gradual stretching of soft tissue. It has got some inherent merits over other prevalent

technique. This is a semi-invasive technique. Length of the foot is effectively lengthened in contra distinction to other methods in which shortening is associated because of osteotomy or arthrodesis.

The clubfoot has a strong tendency to relapse. Rigid persistent deformities are seen in incompletely corrected foot. It is wrongly assumed that relapses occur because the deformity has not been completely corrected. Actually, relapses are caused by the same pathology that initiated the deformity, Errors in ctev correction methods in Ponseti, Improper surgical intervention without adequate conservative treatment, Inadequate post operative care, Non-compliant parents in post correction regime, Failure to do proper tendoachilles tenotomy, Rigid club foot arthrogyrosis, associated aminiotic with-band syndrome, Meningomyelocele, spina bifida, spinal cord defect, Defective or inadequate orthotic fittings, Inadequate or incorrect rehabilitation protocol.

The most common residual deformity causes the front of the foot to point and rotate inwards (forefoot adduction and supination), Equinus at ankle, Cavus & heel varus, In-toeing. The foot can become stiff and changes the loading through the ankle joint. If left untreated residual deformity can lead to misalignment or degeneration of joints in the foot and ankle.

The principle of Ponseti method is all deformity components are corrected simultaneously except equinus which is corrected last usually by percutaneous tenotomy.

2. Materials and Methods

This observational study was conducted on all the patients' with Untreated and relapsed club foot. Since all cases of talipes equino varus not amenable to correction by manipulation and plaster stretching are candidates for this method.

We treated 22 feet of 18 children with relapsed/untreated clubfeet in the age group of 2-7 years were by Ilizarov based fixators by using principle as outlined by Ignacio Ponseti.

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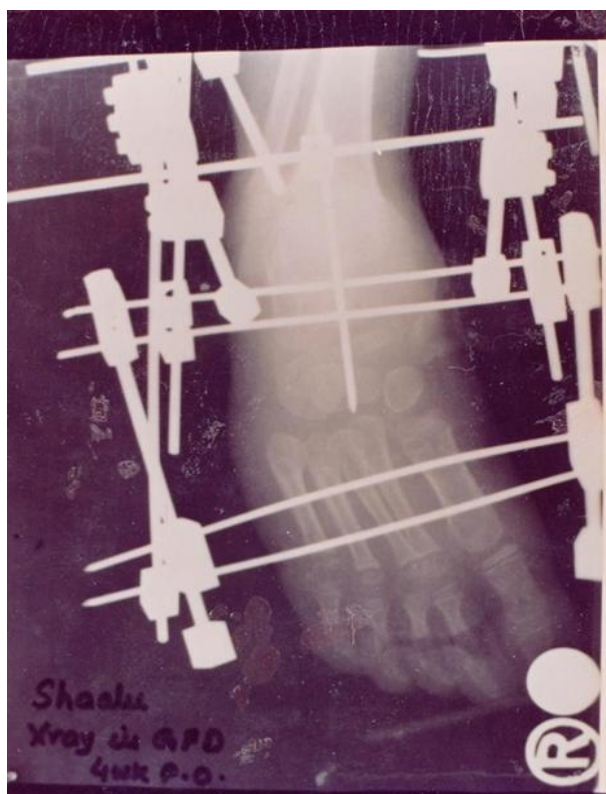
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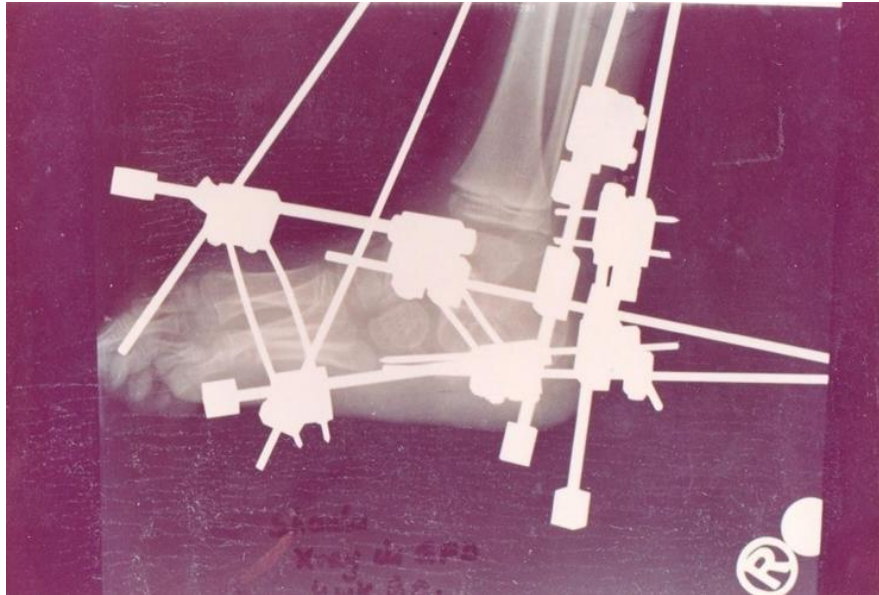
Distraction was started on 3rd postoperative day, including a distraction phase of 3-6 week duration and a static period of 3-6 weeks. In the static period foot was placed in 20 degrees of dorsiflexion and should be kept for twice the period of the

distraction phase. If needed tendoachilles tenotomy or lengthening was also done. After complete correction fixators were removed and usual post operative rehabilitation protocol and orthotic devices were given.



Radiograph at 4 weeks of distraction





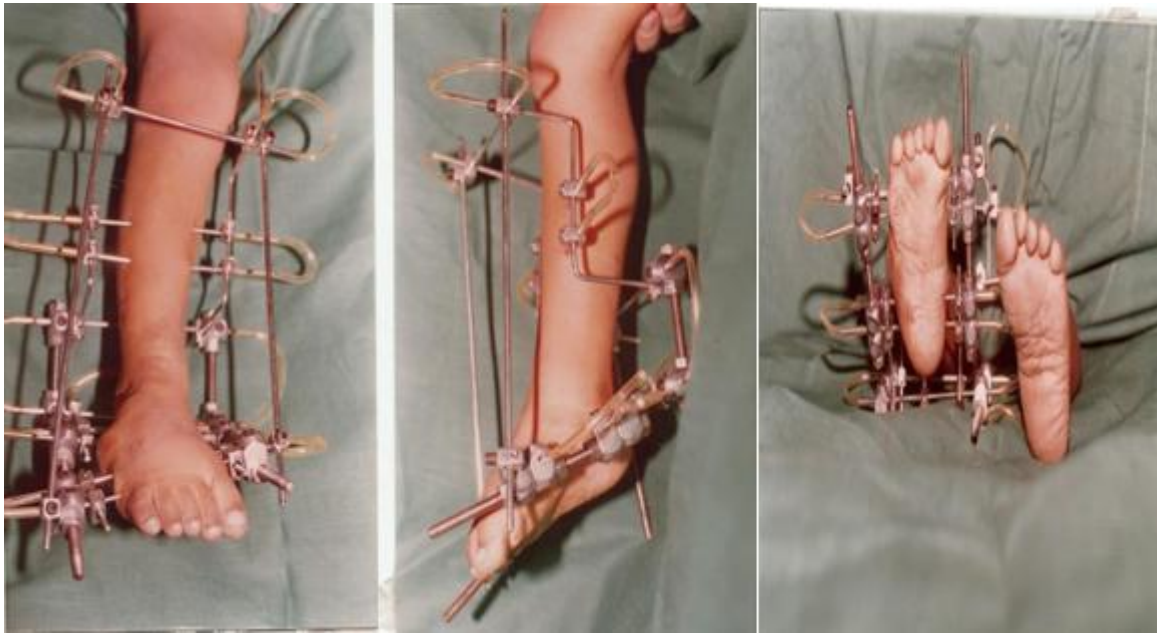
Pre –Operative at the End of Static Phase



Case 2

Pre Operative Photograph



Clinical Photograph Just After Application of Fixtor**Pre operative X-ray at end of StaticPhase****Inclusion Criteria:-**

- Drop outs of conservative treatment.
- Neglected variety.
- Recurrence after surgical release.

Exclusion Criteria:-

- Patients below 2 years and above 7 years of age are excluded.
- We also excluded cases associated with secondary causes like arthrogryposis, meningomyelocele, and so forth.

Patients were thoroughly assessed clinically including podograms and radiologically. Radiological assessments were done in AP and lateral view in stress dorsiflexion in all cases. X-rays were studied for talocalcaneal angle, talo-first metatarsal angle, talo-Vth metatarsal angle (all in AP view), talocalcaneal angle, tibiocalcaneal angle and Calcaneal pitch (all in lateral view) was used in this study. Severity of deformity was assessed by using pirani scoring system and

to assess the correction achieved after final casting. Podograms were taken to assess the weight bearing portion of foot, length, and width of foot before and after completion of treatment. All patients were operated in general anesthesia. Basic assembly consists of three sites of pin holds (Tibial, calcaneal, metatarsal) and three pairs of connections of which tibiocalcaneal and calcaneometatarsal were distractors and tibiometatarsal were connecting rods. After putting all the K-wires (i. e.3 each tibial, calcaneal, and metatarsal), we tried to reduce the deformity by Ponseti method and then by connecting the tibial, calcaneal, and metatarsal attachments we tried to maintain the reduction. After that distractors were placed on both sides between tibial-calcaneal and calcaneal-metatarsal attachments (Figs 1A and B). On the third postoperative day, distraction were started that is, 0.25mm 6 hourly on the medial side while 0.25mm 12 hourly on the lateral side in hospitalized patients. After discharge of the patients from hospital, their parents were instructed to do the distraction at the rate of 1

mm on medial side and 0.5 mm on lateral side once a day for convenience. The first phase ends after clinical and radiological correction of forefoot adduction. Visual correction of deformities was noted during the distraction phase. Weekly x-rays were taken to see correction while in distraction phase. Differential distraction on medial side is performed twice the rate than that of lateral side. Distraction on lateral side not only prevents crushing of the articular cartilage but also permits normal growth of epiphyseal plate on lateral side which may be affected if compression is done on the lateral side. After this initial distraction phase of approximately 3 to 6 weeks the assembly were held in static position for further 3 weeks to allow soft tissue maturation in elongated position. After that assembly were removed and plaster cast were applied in a position of maximum correction. The children were allowed to ambulate full weight bearing in plaster. Three weeks later, more plaster cast were applied. After that appropriate orthosis and/ or splint were applied and patients were followed-up regularly. At the end of 6, 12, 18 and 24 months, all clinical assessments were done and documented. Radiological assessment was also done at the end of 1 year follow-up and was analysed. After 24 months follow-up, patients were told to contact for follow-up annually. They were told to report in case of relapse of any deformity. Cases were considered as failure if:

- There was no or incomplete clinicoradiological correction or
- Complications like joint subluxation, rocker bottom deformity occurred.

3. Evaluation of Results

Results were evaluated on the basis of Pirani scoring system, podogram, radiologically and foot bimalleolar angle parameters. A final Pirani score of 0 to 2 is regarded as good clinical correction achieved. The radiographic examination is accomplished by taking anteroposterior and lateral radiographs. Talocalcaneal angle is taken in both anteroposterior and lateral view. The summation of an anteroposterior and lateral talocalcaneal angles is talocalcaneal index which has normal value of angle of 40 to 85°.

4. Observation and Results

In our study, 77% of children showed excellent results and 22% of them showed good results, at the 2-year follow up, the correction was maintained, implying that there is no risk of recurrence, with a full range of motion at the ankle joint. One patient had skin blister, one patient showed plantar skin necrosis and one patient developed flexion contracture of toes.

5. Discussion

Congenital talipes equinovarus is a common orthopedic problem in children, which have a bulk of the congenital anomalies. Various treatment options including conservative treatment by ponseti-2-6, 9, 11, 12 have been given by various authors for management of club foot with variable

success rate. Surgery is mainly advocated for late, neglected and relapsed feet yet many of them including lehman et al have stated that so called resistant variety of club foot can usually be diagnosed even on first examination of child. These children have a short heel and less pliable foot. These resistant varieties always needs some form of operative intervention. Manipulation and correction by Ponseti technique had been accepted by many orthopedic surgeons as method of choice. Early correction can be achieved with a low recurrence rate by this method.

In our study, we excluded patients which were below the age of 3 years because there was a risk that their soft bones may not be able to bear the distraction forces. We have opinion that child below the age of 3 years can be managed by nonoperative method like ponseti or by soft tissue procedures. Children which were above 6 years of age were also excluded as at this age group there are significant bony changes which may affect the outcome of study.

We managed these feet by differential distraction by JESS.6 It is a semi-invasive procedure, as it does not require any open or percutaneous surgical procedure for the deformity correction. When we desired clinical correction were achieved, foos were supported in corrected position by above knee plaster cast for next 4 to 6 weeks and then were on DB splint. The major drawback was acceptance of assembly by the children. There was also chance of injuries to the children and their attendants while nursing. But the results are quite encouraging giving good correction in much short period. In our study, improvement in medial and lateral border ratio was observed in all cases but complete reversal of ratio could not be obtained. In unilateral cases affected foot remained smaller than normal foot but was cosmetically acceptable. Jain et al¹⁰ in their study FBA parameter showed improvement from grade 3 to grade 1 in 93% cases but our study this parameter improved 82% from grade 3 to grade 1. In our study, radiological parameters were returned to near normal range. The explanation may be that the primary pathology in CTEV is of soft tissue contractures in midfoot and hindfoot. Bony articulation is not marked as skeleton is mainly cartilaginous. So, the main role of distraction is to stretch the contracted ligaments gradually and differentially.

6. Conclusion

We may conclude from the study that clubfeet can be corrected by differential and fractional distraction using an external fixator by applying the ponseti principle gives good correction of deformity and does not increase the rates of recurrence. But in this procedure, the active participation of the patients' attendants is one of the prime factors for the successful outcome.

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