

JOSHI'S EXTERNAL STABILISATION SYSTEM (JESS), FOR RECURRENT CTEV DUE TO IRREGULAR FOLLOW UP

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ABSTRACT

BACKGROUND

The incidence of congenital talipes equinovarus is approximately one in every 1000 live births. Most cases are sporadic in occurrence. Contractures or anomalies of the soft tissues exert further deforming forces and resist correction of bony deformity and realignment of the joints.

MATERIALS AND METHODS

Our study is done with children presenting with clubfoot at different ages from one year to two years of age. The deformity in these children is recurrent because of discontinued treatment after the correction is achieved with serial castings alone or with tenotomy for tendo Achillis. Our study has been done to know the efficacy of JESS fixator as an alternative to avoid soft tissue release and other osteotomies.

RESULTS

The target is set for achieving Pirani's <4 with clinical deformity. These cases are again started on castings.

CONCLUSION

JESS fixator can avoid soft tissue as well as bony procedures to correct the deformity while preserving the normal anatomy.

KEYWORDS

Recurrent CTEV, JESS Fixator, Deformity Correction.

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BACKGROUND

The congenital talipes equinovarus occurs with an incidence of 1 in every 1000 live births. These are sporadic in occurrence. Various theories proposed regarding the cause of clubfoot do not clearly indicate why the severity is seen in some cases. Primary germ plasm defect theory attributes this to defect in talus causing continued plantar flexion and inversion leading to soft tissue changes in the joints and musculotendinous complexes. Theory of primary soft tissue abnormalities attribute the deformity to abnormalities in neuromuscular units, which in turn cause secondary bony changes. Children with clubfoot present with hypotrophic anterior tibial artery along with atrophy of the musculature in the calf. It is well documented that abnormal distribution of type I and type II muscle fibers in clubfoot. The size of abnormal foot maybe one half to one size smaller in length and width.

To treat the clubfoot the pathological changes of anomaly should be considered from planning itself. The clubfoot deformity complex comprises equinus, varus and adduction deformities. The foot with deformity presents a

variety severities for the given deformity. The equinus may involve entire foot with varus deformity of forefoot, adducted and a cavus deformities present. Clubfoot is accompanied by internal tibial torsion. All the joints in the mid and hind foot can be involved in the pathological process.

Contractures or anomalies of the soft tissues exert further deforming forces and resist correction of bony deformity and realignment of the joints. Talocalcaneal joint realignment is opposed by the calcaneofibular ligament. The superior peroneal retinaculum (calcaneal fibular retinaculum), the peroneal tendon sheaths and the posterior talocalcaneal ligament. Resisting realignment of the talonavicular joint are the posterior tibial, the deltoid ligament (tibial navicular), the calcaneonavicular ligament (spring ligament), the entire talonavicular capsule, the dorsal talonavicular ligament, the bifurcated (Y) ligament, the inferior extensor retinaculum and occasionally the cubonavicular oblique ligament. Internal rotation of the calcaneocuboid joint causes contracture of the bifurcated (Y) ligament, the long plantar ligament, the plantar calcaneocuboid ligament, the navicular cuboid ligament, the inferior extensor retinaculum (cruciate ligament), the dorsal calcaneocuboid ligament and occasionally the cubonavicular ligament.

The metatarsals also often are deformed. They may deviate at the tarsometatarsal joints or these joints maybe normal and the shafts of the metatarsals become adducted.

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If the clubfoot is persisting, many other late adaptive changes occur in the bones leading to irreducibility with manipulations. These changes depend on the severity of the soft tissue contractures and the effects of walking. In untreated adults, some joints may spontaneously fuse or they may develop degenerative changes secondary to the contractures.

The initial examination of the foot and the progress of treatment should depend on clinical judgment and radiographic examination. A standard radiographic technique and clear instructions to the technician are essential.

Classifications by Pirani et al and Dimeglio et al are based solely on physical examination and require no radiographic measurements or other special studies. Pirani's system is composed of 10 different physical examination findings (Figure 1), each scored 0 for no abnormality, 0.5 for moderate abnormality or 1 for severe abnormality. Each foot is assigned a total score, the maximum being 10 points with a higher score indicating a more severe deformity. In the system of Dimeglio et al, four parameters are assessed on the basis of their reducibility with gentle manipulation as measured with a handheld goniometer- (1) Equinus deviation in the sagittal plane; (2) Varus deviation in the frontal plane; (3) Derotation of the calcaneopedal block in the horizontal plane; and (4) Adduction of the forefoot relative to the hindfoot in the horizontal plane. Flynn et al compared the two systems in the evaluation of 55 clubfoot by two orthopaedic surgeons and found that both had very good interobserver reliability after the initial learning phase.

The initial treatment of clubfoot is nonoperative. Various treatment regimens have been proposed including the use of corrective splinting, taping and casting. Treatment consists of weekly serial manipulation and casting during the first 6 weeks of life followed by manipulation and casting every other week until the foot is clinically and radiographically corrected. With experience, the clinician is able to predict, which feet would respond to nonsurgical treatment. The more rigid the initial deformity, the more likely that surgical treatment will be required.

The order of correction by serial manipulation and casting should be as follows- first, correction of forefoot adduction; next, correction of heel varus; and finally, correction of hindfoot equinus. Correction should be pursued in this order so that a rocker bottom deformity would be prevented by dorsiflexing the foot through the hindfoot rather than the midfoot. The success rate of serial manipulation and casting as reported in the literature ranges from 15% to 80%.

On the higher side, successful correction of clubfoot deformity generally is reported in 90% to 98% of children treated with Ponseti casting. Bor et al, Goksan et al and Morcuende et al reported that Ponseti casting can be used in children 2 years old, even after previous unsuccessful nonoperative treatment. Achilles tenotomy or anterior tibial tendon transfer is added to the casting routine when necessary. Percutaneous Achilles tenotomy was required in 85 (85%) of 100 feet reported by Changulani et al in 35

(97%) of 36 feet in the series of Bor et al in 90 (67%) of 134 feet described by Goksan et al in 200 (91%) of 219 feet treated by Dobbs et al and in 36 (72%) of 50 feet reported by Scher et al. In a study to predict the need for tenotomy, Scher et al found that patients with a Pirani score of 5 or grade VI by the system of Dimeglio et al are very likely to require tenotomy.

The Ponseti method consists of two phases- treatment and maintenance. The treatment phase should begin as early as possible, optimally within the first week of life. Gentle manipulation and casting are done weekly.

Maintenance Phase- When the final cast is removed, the infant is placed in a brace that maintains the foot in its corrected position (abducted and dorsiflexed). The brace (foot abduction orthosis) consists of shoes mounted to a bar in a position of 70 degrees of external rotation and 15 degrees of dorsiflexion. The distance between the shoes is set at about 1 inch wider than the width of the infant's shoulders. This brace is worn 23 hours each day for the first 3 months after casting and then while sleeping for 2 to 3 years.

Management of Recurrence- Recurrence of the deformity is infrequent if the bracing protocol is followed closely. Early recurrences (usually mild equinus and heel varus) are best treated with several long leg casts applied at 2-week intervals. The first cast may require some dorsiflexion of the first ray if cavus deformity is present. Subsequent casts abduct the foot around the talar head correcting the varus and ultimately allowing ankle dorsiflexion. Achilles tendon lengthening maybe necessary if dorsiflexion is insufficient when the lateral cuneiform ossifies (at about 2 to 3 years old), transfer of the anterior tibial tendon to the lateral cuneiform maybe necessary to help maintain correction.

Functional distraction using JESS can be utilised as an alternative method in cases of neglected and resistant clubfoot.¹ Differential distraction by fixator for the correction of neglected idiopathic CTEV is an effective and patient-friendly method of management.² The mean strength of the JESS was 32.5 N/mm in experiments and 35.3 N/mm infinite element analysis; the difference was 8.4%.³

Forefoot adduction remains a difficulty from using previous corrective methods.⁴ The initial management of CTEV by Ponseti method has many advantages. The Ponseti group also scored higher than the surgical group in terms of patient satisfaction with significantly better parent-rated OxAHQ scores in the "emotional" and "school and play" domains.⁵

CTEV and its recurrence if left untreated, it can result in long-term disability/deformity. Interventions can be conservative (such as splinting or stretching) or surgical.⁶

Parent counselling is of utmost importance before and during the course of deformity correction. Any deviation in the regular follow up can lead to delay in correction and even recurrence. This poses a newer issue, because of weightbearing at around 10 months of age on an uncorrected foot before achieving a plantigrade foot will lead to bony deformity creating incongruous surfaces at the joints.

MATERIALS AND METHODS

Our study is done with children presenting with clubfoot at different ages from one year to two years of age. The deformity in these children is recurrent because of discontinued treatment after the correction is achieved with serial castings alone or with tenotomy for tendo Achilles.

This study was done to know the efficacy JESS fixator as an alternative to avoid soft tissue release and other osteotomies.

The inclusion criteria for the study were- a) Children of one or two years of age; b) Previous history of serial manipulations for deformity corrections; c) Child has already started walking; d) Persisting clinical and radiological deformity even after application of three casts after the child has been brought with recurrence. The Pirani scores of 6 and above only are included in the study. The compliance of the child with recurrence is an issue because trying manipulation and cast application is difficult with a child who has already started walking though the parents are willing to try the cast application due to recurrence.

The exclusion criteria were- a) Deformity with other congenital conditions; b) Previous posteromedial soft tissue release; c) Pre-existing callosity with cracks and doubtful infections.

RESULTS

The study included 32 children fulfilling the above criteria with age distribution and severity scores as given in the tables.

Age	Children
12 months	6
13-15 months	19
16-18 months	3
19-24 months	4

Table 1. Age Distribution in 32 Cases

Pirani Score	Children
7	3
8	5
9	19
10	5

Table 2. Severity Distribution in 32 Cases

Treatment	Children
Manipulation and casting alone	20
M and C with TA tenotomy	12

Table 3. Previous Treatment

Every child was treated with gentle manipulation and casting and observed for any improvement in Pirani scores. None of the children could be brought down to Pirani's score 7 with castings for 3 weeks.

The lowest score in the study was 7, highest being 10. All these children were evaluated for surgical fitness. JESS fixators were applied under general anaesthesia. The position in which fixator applied was the maximum corrected position by ruling out any blanching delay in the toes.

A standard JESS fixators were used with a set of distraction rods for leg and another for foot. The K wires were introduced below tibial tuberosity, calcaneum, first and second, fifth and fourth metatarsals. The size of the distractor rods are chosen to facilitate over correction of the deformity (Figure 1). The initial 4 days are for observation of pin track sites and excessive swelling that can occur due to the trauma.

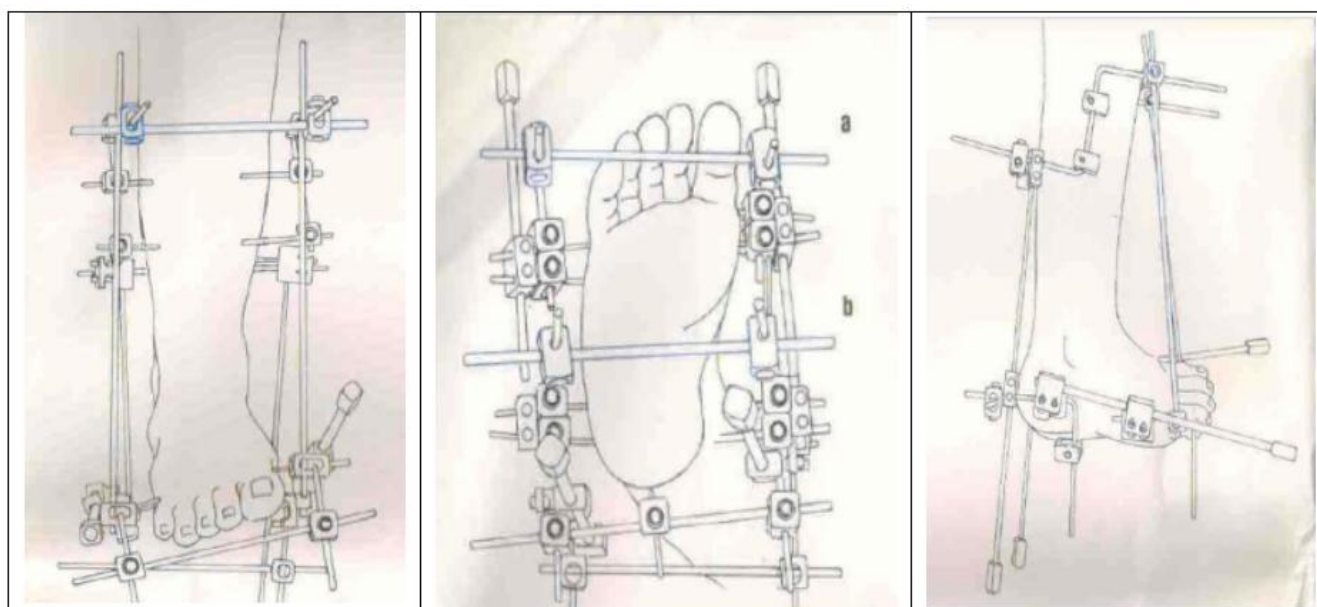


Figure 1. Pin Placement for JESS Fixator



Figure 2. Stages of Treatment

PIRANI SCORING
OF CLUB FEET

A 0.5

B

C

D 0.5

E

F

DATE																			
Side	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
A Curve lat border																			
B Medial Crease																			
C Talus Head																			
Midfoot Score																			
D Post Crease																			
E Equinus Rigidity																			
F Empty Heel																			
Hind Foot Score																			
Total Score																			
Complications: Yes/No																			
Treatment																			

Treatment Code: M manipulate, C cast, T tenotomy B braces O other (describe):
Complications:
Clinical Examination (check if normal, describe if abnormal)
Head & Neck Upper limbs Spine Lower limbs
Describe:
Consent Given: Yes No
Diagnosis: CTEV Syndromic TEC Positional Talipes Normal Other(describe)

Figure 3. Pirani Scores

The fractional distraction is done on the posterior side and medial side as 1 mm per day and compression by 1 mm on lateral side by total 1 mm in 4 days. The children are given oral cefuroxime and NSAIDS till first one week along with pin site dressings. At the end of every week force dissipation rods are readjusted according to the correction achieved. The attendants of the patients are counselled and demonstrated about the process and the progress is shown as and when the force dissipation rods were adjusted. Both

the clinical and radiological correction are evaluated every two weeks.

The target is set for achieving Pirani's <4 with clinical deformity. These cases are again started on castings.

The fixators were removed after over correction is achieved and maintained for double the time required to get the correction. After removal of the fixator, children are given above knee castings again to maintain the corrected position and also till the pin sites are healed without any

soakage of the casting for 3 times with 3-week interval between the castings.

Two children developed raise in temperature and pin site infections during the fourth week of distraction. The procedure was abandoned to prevent osteomyelitis. Subsequent to the removal of fixator, the fever and discharge from the pin site subsided.

The results were evaluated according to the over correction achieved, i.e. plumb line to pass medial to the foot and 10 to 15 degrees of dorsiflexion.

These parameters are consistent with Pirani scores less than 4. Achieving correction into overcorrected position took 5 to 8 weeks depending on the initial Pirani score. The scores 7 to begin with took 5 weeks for overcorrected position. The scores 8 to begin with took 6 weeks for overcorrected position. The scores 9 to begin with took 7 weeks for overcorrected position. The scores 10 to begin with took 8 weeks for overcorrected position. This is directly proportional to the initial severity in Pirani scores and also reflects in the period for which the child has walked with deformity.

After the removal of the fixators, the 28 children are reevaluated at the final removal of the castings, which did not show any deterioration of the scores. In fact, the overcorrected position showed development of contractures during the last two maintenance castings requiring manipulation.

The major complication noticed during the study was infection, which presented with high-grade fever and pin site discharge. The procedure was abandoned at third week to prevent osteomyelitis.

CONCLUSION

Based on the findings of this study one can conclude that (a) Parent compliance is very essential in the management of CTEV, the recurrence due to noncompliance can be prevented by counselling the parents about the importance of follow up till the child achieves a plantigrade foot and through the maintenance. (b) Recurrent CTEV is also better managed as early as possible to prevent longer hospital stays and lengthy treatment to achieve correction and to maintain it. (c) JESS fixator can be tried after reapplication of casting for all the recurrent cases. (d) JESS fixator can avoid soft tissue as well as bony procedures to correct the deformity while preserving the normal anatomy.

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