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Correction Of Resistant / Neglected Club Foot By Joshi External Stabilization System Fixator

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Abstract:*Club Foot is the most common congenital deformity. It can be identified at birth by observing forefoot adduction, hind foot inversion,pes cavus and equinus deformity. The study was conducted to evaluate the functional outcome of controlled fractional differential distraction in the management of neglected and resistant club foot by Joshi's external Stabilization System (JESS).After removal of fixator casting was given for 3 weeks and children were given Ankle-Foot Orthosis to be worn at night for a period of 3 yrs. Total of 16 cases (17 feet) were studied, which were corrected by JESS. Severity of the deformities and clinical correction was assessed by modified Pirani scoring.Serial following up of patients showed good maintenance of correction with only complication of subtalar and ankle joint stiffness which is compensated bythe other small joints of the midfoot and forefoot*

Keywords:*Adduction,Club foot,Equinus, JESS,Resistant*

I. Introduction

Club foot, a hereditary foot deformity is one of the commonest congenital foot anomalies presenting to a paediatricorthopaedic surgeon. Congenital talipes equinovarus deformity (CTEV) isa three dimensional deformity having four components – equinus, Varus, adduction and cavus. Its incidence is 5-6 per 1000 live births,varying with race and geography [1]. The goal of CTEV management is to reduce, if not to eliminateall elements of the clubfoot deformity, hence achieving afunctional, pain free, normal looking plantigrade, mobile, callous free, and normally shoeable foot [1]. Inthe older child, issue of correction of deformities becomesmore complicated by additional skin scar, fibrosis of previoussurgery which need extensive soft tissue surgeries alongwith various bony osteotomies and forcible manipulation [2, 3]. None of the procedures [4- 6] can completely achieve the goalof functional, painless, and cosmetically acceptable completeplantigrade normal foot in such cases. This study was conducted to evaluate the clinic-radiologicaloutcomes of neglected /relapsedCTEV managed by Joshi's External Stabilization System (JESS).It is a simple external fixator system which utilizes the principles of differential distraction to treat CTEV. It is simpler to apply than the Ilizarov fixator and it is a semi-invasive technique. It was indigenously developed by late Dr. BB Joshi, an Indian orthopaedic hand surgeon. In our study, we intended to use the indigenous assembly of distracters and static rods held by link joints to transfixed k-wires for correction of all components of this deformity. This method involves controlled differential fractional distraction thatis, distraction histogenesis/ligamentotaxis, to correct deformity by gradual stretching of soft tissue without compromising neurovascular status of the limb to gain a reasonably supple, cosmetically acceptable footwith durable corrections of deformities. Management of neglected/relapsed CTEV by the principles of differential distraction by external fixators has been criticized in the Western world – psychological implications, pin tract infection, reflex sympathetic dystrophy, and stiffness of the ankle and subtalar joint, poor functional outcomes and the risk of recurrence of deformity.

II. Materials And Methods

Present study was done at Department of Orthopaedics, Sri Ramachandra Medical College and ResearchInstitute, Sri Ramachandra University, Chennai, India during Jan 2013 – Jan 2016. A total of 17 neglected and relapsed CTEV foot were included in the study.Out of 17 foot, 1 was bilateral club foot.More male patients were brought for the corrective procedure then females. There were 11 male and 5 female patients.Out of 16 patients, 7 were neglected cases, 4 cases had relapsed after casting, and 5 had relapsed after soft tissue releases. In one child we had done this procedure on one side and posteromedial release on the other

side which served as a comparison. The minimum age was 1 year and maximum was 7 years (mean age-3years).We looked at these children with CTEV treated by the JESS.
All patients included in this study were thoroughly assessed clinically by .Modified Catterall Pirani scoring system which was used in this studyto assess the severity of deformity and to assess the correctionachieved after final casting. We operated all our patients under general anaesthesia. Repeat assessment was done at the end of 3rd, 6th, 9th month after removal of JESS fixator and results were analysed. They were told to report in case of relapseof any deformity. Cases were considered as failure if (a)there was no or incomplete clinico-radiological correctionor (b) complications like joint subluxation, rocker bottomdeformity occurred.

Inclusion Criteria include (1) Failed conservative treatment (2) Neglected variety (3) Recurrence after surgical release While the exclusion criteria included (1) Age below 1 year and above 7 years, (2) Syndromic children (3) Neurogenic feet.

1.1, Components of the frame

1.1.1, UntensionedKirschner (K) wires

Knurled rods in various shapes – straight (of varying lengths), L shaped, Z shaped

1.1.2, Distractors

Clamps to connect the K wires to the rods and to connect rods to each other.
There are 3 sizes of this system – small, medium and large – chosen according to age and size of foot.

1.2, Construct

1.2.1, Tibial hold

2 transverse K wires (just distal to tibial tuberosity) inserted from lateral to medial connected by 2 L rods or a single Z rod with the distal limb placed posteriorly. The limbs of the medial and lateral rods were connected with transverse rods.
An additional AP K wire inserted and fixed to anterior transverse rod

1.2.2, Calcaneal hold

2 transverse (perpendicular to heel) K wires inserted from medial to lateral and anterior to posterior calcaneal tuberosity- medially and laterally connected by L rods – each protruding limb connected with transverse rods-axial calcaneum wire in line with longitudinal axis of calcaneum and directed towards 4th metacarpal fixed to transverse rod.

1.2.3, Metatarsal hold

1 K wire passing through at least the 1st and 5th metatarsal neck. Proximal wires placed through 5th to 3rd metatarsals from lateral and 1st to 2nd metatarsals from medial (confirmed by noting exit of wiresbetween 2nd and 3rd metatarsals) – connected medially and laterally by L rods and limbs on each side connected by transverse rods

Medial and lateral tibiocalcaneal and calcaneo-metatarsal distractors. We did not use an anterior connecting rod between tibial and metatarsal hold.

Differential distraction was begun on the 2nd post-operative day. There is a square nut which has to be turned to enable distraction. Medial distracters (tibio-calcaneal and calcaneo-metatarsal) were distracted 1 mm / day divided into four 90 degrees turn. Lateral distracters were distracted 0.5 mm/ day divided into two 90 degrees turn of square nut. At the completion of distraction when deformity appeared visibly corrected, the anterior metatarso-tibial connecting rod was added to stabilize the construct. The fixator was retained for a period of twice the distraction period in order to allow the stretched ligaments and capsule to heal. Once the fixator was removed, an above knee cast was given with the foot in maximum abduction and dorsiflexion. In case of persistent equines deformity or restricted dorsiflexion, posterior TendoAchilles tenotomy was done at the time of fixator removal.

III. Observations And Results

Mean duration of distraction was done for 4 weeks (range 3 to 5 weeks) while mean duration in fixator was 10 weeks (range 9 to 14 weeks). The children included this study were followed up for 2 years. Following the JESS removal subtalar and ankle stiffness was observed in all children where the range of movements correlates with age with younger children having better range of motion. The observations in the study showed only an average range of movements at subtalar (inversion and eversion) and ankle joint (dorsiflexion and plantar flexion)of 10 to 20 degrees. 4 children required lateral transfer of tibialis anterior, 3 children required posterior capsulotomy of ankle and subtalar joint with tendoAchilles lengthening and 2 children required calcaneocuboid fusion as additional procedures.

IV. Complications

Three children reported pin tract infection of calcaneal wires which subsided with dressing and oral antibiotics while 2 children came with the complication of cutting out of calcaneal wires requiring re-application. Common problem noted was loosening of nuts which was seen in four children for which parents were taught to tighten nuts at least twice a week and other complication observed in the above study was flexion contracture of toes where parents were taught to manipulate toes into extension after every meal. Usually with follow up flexion contractures gradually resolved in most patients

Cutting out of calcaneal wires

V. Discussion

In one child we had done a Posteromedial release on the opposite side and this was used for comparison. Deformity was well corrected in both feet but the ROM of ankle and subtalar joints was slightlybut not significantly better in the PMR foot compared with the JESS foot. Both sides required later lateral transfer of tibialis anterior. Hence as far as the correction of deformity is concerned external fixators can achieve equally good results in comparison with posteromedial releases but the feet may be stiffer.

Even though the deformity is well corrected, the feet are stiff which does not improve with time. At the time of removal the feet appear very supple but this stiffens over a period of 3 months. But the children manage to squat and play well probably because of compensatory movements in the midtarsal and tarsometatarsal joints. Children adjust very well to the fixator and there was no long term psychological implications of applying the fixator.

JESS is a simple system which can be easily applied by all once the system and components are well understood. It is easier to apply than the Iizarov fixator. But we did not use it in children older than 7 years in whom we preferred the Ilizarov fixator as we were conversant with it.

VI. Conclusion

JESS is a simple versatile external fixator system which can be used for the correction of club foot in older children. The deformity is clinically well corrected by the principles of differential distraction. But the loss of ankle and subtalar movements is an issue. Loss of correction can occur as the child grows which can be addressed by ala carte procedures depending on the recurrent deformity and importantly parents of these children are immensely satisfied with the correction

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