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Management of Bilateral Equinocavovarus Foot in Cerebral Palsy Using Soft Tissue Release and JESS Fixator: Case-Based Comparative Insight

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Abstract: ***Equinocavovarus deformity in cerebral palsy is a complex multiplanar deformity resulting from muscle imbalance and progressive contracture. Management depends on deformity flexibility and severity. We report a case of a 7-year-old male with spastic diplegic cerebral palsy (GMFCS IV) with bilateral equinocavovarus deformity. The right foot was treated using soft tissue balancing followed by gradual correction using Joshi's External Stabilization System (JESS), while the left foot underwent tendo-Achilles lengthening and plantar fascia release. Plantigrade position achieved in left foot immediately right after surgery, while on right foot it was achieved within 3 months. Patient was followed up for 1 year eliciting maintained correction in bilateral feet; however, superior correction of cavus and varus was observed on the JESS-treated side.***

Keywords: Cerebral palsy, Equinocavovarus, JESS fixator, External fixation, soft tissue release

1. Introduction

Foot and ankle deformities are reported in up to 90–95% of children with spastic cerebral palsy at some point in their development, with equinovarus deformity affecting approximately 6–10% of cases [1,2] In spastic diplegic Cerebral Palsy (CP), the equinocavovarus deformity represents a complex, multi-planar distortion of the foot's architecture. These deformities are generally bilateral but often asymmetric, meaning one foot may be more rigid or severe than the other and occur due to imbalance between the invertors and evertors of foot and ankle, characterized by overactivity of the Tibialis posterior and Tibialis anterior muscles along with weakness of the Peroneal muscles, Gastrocnemius-soleus spasticity and Plantar fascia tightness. [3,4] Initially dynamic, the deformity may progress to fixed contractures with growth if untreated. [5]

Management depends on age, flexibility of deformity and functional status. Flexible deformities respond to soft tissue procedures and/or orthotics, whereas rigid deformities often require extensive correction with osteotomies or gradual correction using external fixation systems such as Joshi's External Stabilization System (JESS). [6,7] This case highlights a unique intra-patient comparison using the two different modalities.

2. Case Report

A 7-year-old male with spastic diplegic cerebral palsy (GMFCS IV) presented with difficulty in ambulation and bilateral equinocavovarus deformity. The following clinical findings were noted: (1) Fixed equinus: 30–40° plantarflexion, (2) Hindfoot varus: 15–20°, (3) Forefoot adduction, (4) Cavus deformity with tight plantar fascia, (5) Modified Ashworth Grade 2–3 spasticity, (6) Silfverskiöld test confirming gastrocnemius-soleus contracture.

Figure 1: Preoperative image depicting bilateral equinocavovarus deformity

3. Procedure

Written informed consent was obtained from the patient's guardians for publication of clinical details and images. Institutional ethical guidelines were followed.

Patient underwent surgery for bilateral side during the same setting.

Right foot:
Deformity was corrected by soft tissue balancing (Steindlers release, Tendoachillies tenotomy and adductor release) followed by application of Joshi's External Stabilization System (JESS). The construct consisted of three assemblies: (1) Forefoot Assembly: Two K-wires inserted through the 1st and 5th metatarsals. (2) Hindfoot Assembly: Two K-wires passed parallelly through the calcaneum from the medial to lateral surface. (3) Leg Assembly: Two K-wires inserted in distal tibia. All assemblies were connected using rods and distractors forming a modular frame.

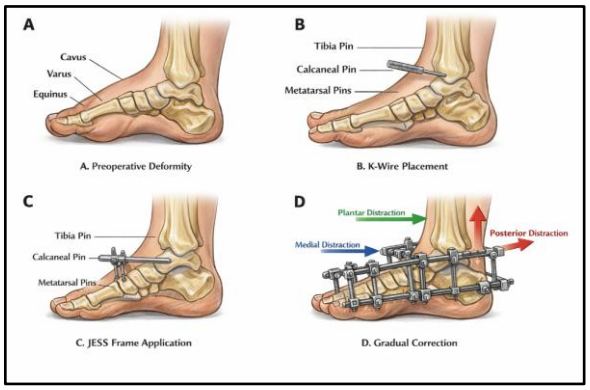

Figure 2: Schematic representation of deformity correction using JESS fixator.

Distraction was Initiated at 48–72 hours postoperatively at the Rate of 0.25 mm × 4 times/day (≈1 mm/day), following the principle of controlled differential distraction. Concave side distraction = 2× convex side i.e. Medial rods: 2 turns/day while Lateral rods: 1 turn/day. Duration of distraction was 3 weeks, followed by 3 weeks of consolidation, after which the fixator was removed.

The deformity correction was done in the following sequence, Cavus corrected first via plantar distraction, followed by Varus and adduction correction via medial and lateral column distraction, Equinus correction done last via posterior distraction.

JESS is thus a system that provides Multiplanar deformity correction, based on Illizarov tension-stress principle of distraction histogenesis with precise correction of rigid deformity. Gradual correction avoids neurovascular compromise, avoids extensive soft tissue dissection and allows postoperative adjustments. [7,8]

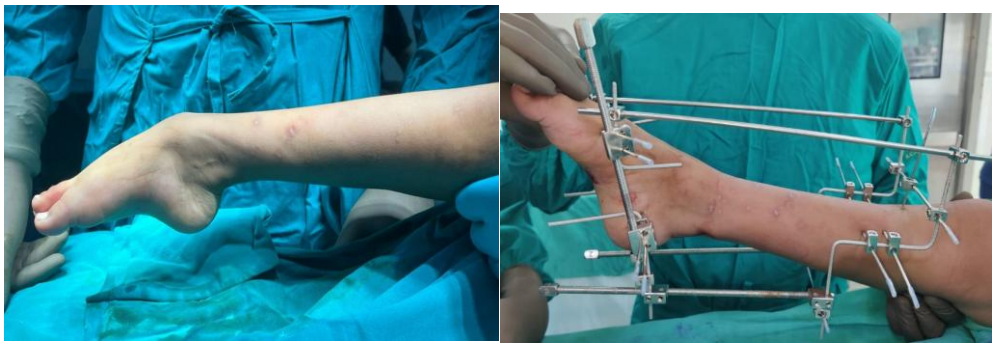

Figure 3: (above) pre-operative right foot. (below) post-application of JESS fixator.

Left foot:
Left foot treated with tendoachilles lengthening, plantar fascia release, adductor brevis release followed by application of below knee cast, post-procedure in corrected position. Cast was removed after 6 weeks.
The following Soft Tissue Releases were done:

- Tendo-Achilles Lengthening- by Z-lengthening technique. Goal: to correct equinus component.
- Plantar Fascia Release to reduces cavus deformity and improve midfoot flexibility.
- Posterior capsular release to improve ankle dorsiflexion.

Figure 4: (left) pre-operative left foot. (right) post-operative with below knee cast application.

Post Operative – Outcome Assessment

Plantarflexion was corrected to neutral - 5° of dorsiflexion. Hindfoot varus was reduced to <5°. Improved plantigrade foot bilaterally. The AOFAS score improved from 50 to 95 with better correction observed on JESS-treated side.

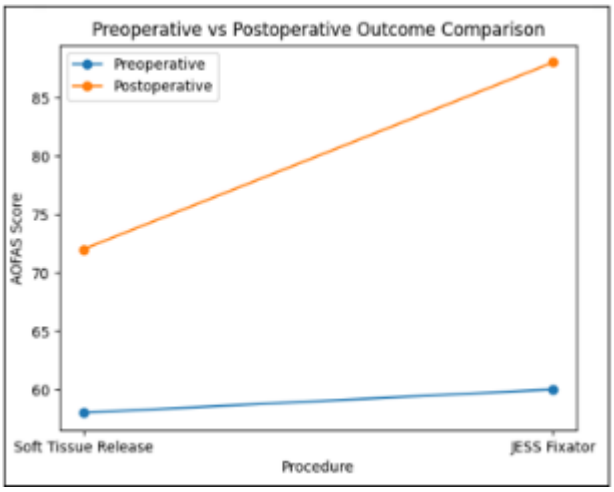

Figure 5: Comparison of deformity correction achieved with soft tissue release versus JESS fixator

Functional outcome was assessed using the American Orthopaedic Foot and Ankle Society (AOFAS) score. Preoperative AOFAS score: 50. Postoperative AOFAS score (6 weeks): 95

The patient achieved a plantigrade foot on both sides with improved weight-bearing and gait stability. The limb treated with JESS fixator demonstrated better correction of hindfoot alignment compared to the side treated with soft tissue release alone.

4. Follow Up

The patient's follow up done at 6 weeks postoperatively depicted satisfactory correction. Patient was regularly followed up for 1 year, with maintained correction bilaterally and no recurrence. Ankle foot orthosis (AFO) being used by patient continuously.

Further long-term follow-up is ongoing to assess maintenance of correction and functional outcomes.

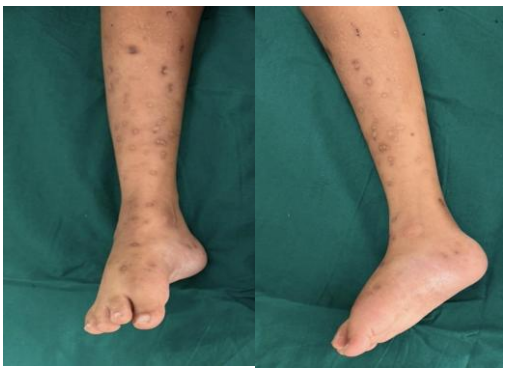

Figure 6: Right foot - Postoperative correction at 1 year (JESS fixation side)

Figure 7: Left foot - Postoperative correction at 1 year (soft tissue release side)

5. Discussion

Equinocavovarus deformity in cerebral palsy is a complex, progressive, multiplanar condition arising from muscle imbalance—spasticity of the gastrocnemius-soleus, tibialis posterior, and intrinsic muscles, along with peroneal weakness. [3,4] Early deformities are flexible and respond well to conservative or soft tissue procedures, whereas long-standing cases become rigid and require more extensive correction.

Soft tissue procedures such as tendoachilles lengthening, plantar fascia release, and tendon balancing are effective in flexible deformities but have higher recurrence rates in rigid cases due to persistent neuromuscular imbalance. Gradual correction using external fixation (e.g., JESS), based on distraction histogenesis, enables controlled, staged deformity correction with improved alignment and reduced soft tissue compromise. [7,9]

In this case, bilateral deformities were managed using different approaches- soft tissue release alone on one side and combined soft tissue release with external fixation on the other- allowing intra-patient comparison. The side treated with gradual correction with external fixation demonstrated superior alignment and maintenance, supporting its use in rigid deformities.

The primary treatment goal remains achieving a painless, plantigrade, and functional foot. However, findings are limited by the single-case design and short follow-up, highlighting the need for larger studies with long-term outcomes.

6. Conclusion

Management of equinocavovarus deformity should be individualized based on severity and flexibility. Soft tissue procedures are effective for flexible deformities, while gradual correction with external fixation (e.g., JESS) offers a reliable option for rigid deformities, enabling safe multiplanar correction. This case emphasizes tailoring treatment to deformity rigidity and demonstrates, through intra-patient comparison, the value of selecting appropriate modality—particularly in resource-limited settings.

References

[1] Gough M, Shortland AP. Could muscle deformity in children with cerebral palsy be related to an impairment of muscle growth and altered adaptation? Dev Med Child Neurol. 2020. DOI: 10.1111/dmcn.14498
[2] Novak I et al. State of the evidence in cerebral palsy management. Dev Med Child Neurol. 2020. DOI: 10.1111/dmcn.14573
[3] Shore BJ, White N, Graham HK. Surgical correction of equinovarus deformity in CP. J Pediatr Orthop. 2021. DOI: 10.1097/BPO.0000000000001850
[4] Davids JR. Foot deformities in cerebral palsy. J Am Acad Orthop Surg. 2021. DOI: 10.5435/JAAOS-D-20-01030
[5] Rutz E, Brunner R. Natural history of foot deformities in CP. Foot Ankle Clin. 2020. DOI: 10.1016/j.fcl.2020.02.003
[6] Kadhim M et al. Surgical management of equinus deformity in CP. J Child Orthop. 2020. DOI: 10.1302/1863-2548.14.200134
[7] Paley D. Principles of deformity correction using external fixation. Strategies Trauma Limb Reconstr. 2021. DOI: 10.1007/s11751-021-00420-8
[8] Ilizarov GA principles revisited in modern orthopedics. Clin Orthop Relat Res. 2020. DOI: 10.1097/CORR.0000000000001213
[9] Ferreira RC et al. Outcomes of external fixation in foot deformities. Foot Ankle Int. 2021. DOI: 10.1177/10711007211008954