

Tibialis Anterior Tendon Transfer for Early Recurrence for Club Foot Deformity

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Abstract

Background: Recurrent deformity in clubfeet treated with Ponseti technique is seen in 30% children. Tibialis anterior tendon transfer to lateral cuneiform is a standard recommendation in children with dynamic supination in gait.

Questions/Purposes: We assessed eversion -to- inversion strength, ankle ROM, foot alignment, function, satisfaction, and quality of life in children between two-five years of age with clubfeet, which recurred after Ponseti treatment, and who met indications for TATT surgery.

Materials and Methods: Fifteen children with idiopathic clubfoot were included for surgery (2005 - 2018). Seven had bilateral involvement, four had additional soft tissue procedures with TATT, ten required average of three-four casts prior to surgery. Assessment of above mentioned parameters at baseline, and at three, six and twelve months was done and outcomes were compared with those of age-matched children.

Results: At baseline, the TATT group had a significantly worse eversion-to-inversion strength ratio, ankle ROM, foot alignment, function, satisfaction and Laaveg-Ponseti score. Eversion strength improved at three months after surgery. function and satisfaction improvements were maintained at 12 months after surgery in 12 out of 15 patients, while three required subsequent procedures for correction of residual deformity.

Conclusion: TATT surgery is simple and effective procedure, to correct early recurrence in children treated by ponseti technique. TATT restores the balance of eversion-to inversion strength, alignment of foot, function and satisfaction outcomes similar to those of age-matched children with corrected idiopathic clubfoot.

Keywords: Recurrent Dynamic Supination Deformity; Ponseti Method; Tibialis Anterior Transfer

Abbreviations

TATT: Tibialis Anterior Tendon Transfer; TA: Tendo Achilles; ROM: Range of Motion; FPA: Foot Progression Angle; IITV: Image Intensifier Television; AFO: Ankle Foot Orthoses

Introduction

One of the most common sequelae of conservative treatment of congenital clubfoot deformity is in toeing with dynamic supination, which results from a strong tibialis anterior muscle and relatively weak peroneal muscles [1-8]. As different deformities may co-exist simultaneously, surgical options can vary between cases [9-11].

Tendon transfer procedures have been shown to cause minimal stiffness as the correction occurs by a dynamic corrective force, particularly attractive in these children where pain and stiffness are potential problems.

This study was done to evaluate the functional outcomes of surgery in children between two to five year with dynamic supination deformity after treatment with ponseti method. The technique was originally described by Garceau [12].

Materials and Methods

We retrospectively reviewed the medical records of 15 (22 feet) patients with congenital idiopathic clubfeet who underwent TATT surgery. All children initially had been treated by serial manipulation and casting with TA tenotomy as per the Ponseti method. All procedures were done by the senior author at a single institution between 2005 to 2018. Ten children required average of three casts pre-operatively using Ponseti techniques to stretch foot deformity before tendon transfer. Out of 15 patients seven had bilateral involvement while eight had unilateral deformity. All patients had pre surgery clinical examination and video gait recording and scoring by the Laaveg-Ponseti score.

Procedure

All surgical procedures were performed by senior author using a technique similar to that described by Thompson, *et al* [4]. In all children, a complete transfer of tibialis anterior tendon was done to the lateral cuneiform. The tendon was exposed through a dorsomedial incision. The entire tendon resected from its insertion and tagged using a Bunnell suture. It was tunneled subcutaneously over to the lateral aspect of foot. A hole was drilled into third cuneiform under IITV Guidance. The tendon was pulled through the hole into sole and tied over felt and button. A above knee cast was applied for six weeks and child was kept non weight bearing. Additional soft tissue corrective procedures as posterior release were needed in four patients.

AFO was used for three month post operatively and ROM strengthening exercises of transferred tendon instituted at six weeks from surgery.

Assessment at baseline (before surgery), and at three, six, and twelve months (after surgery) included eversion-to-inversion strength, ankle ROM, foot alignment (Foot progression angle), function, satisfaction and quality of life by Laaveg-Ponseti score.

Results

In our study total fifteen children were taken for TATT procedure. On follow up at 12 month eversion-to-inversion strength improved by grade two in 10 patients and by grade three in three patients while two patients had improvement by only one grade in muscle strength. 12 patients showed improvement in FPA 0 - 10 degree external compared to pre-treatment FPA 10 - 25 degree internal, Laaveg-Ponseti score was excellent (90 to 100) in 6 patients and good (80 to 90) in 6 patients showing marked improvement in function. There was resolution of the dynamic supination and inversion in gait in 12 patients. There was significant improvement in range of dorsiflexion and 5 patients had improvement of ankle dorsiflexion of 20 degrees and 10 showed improvement of 10 degrees as compared to preoperative range (-10 to 10 degree). Out of fifteen patients three patients had forefoot adductus and curved lateral border which was graded by

the Pirani score as 1. Of these three patients, two subsequently underwent lateral column shortening and one had an additional medial cuneiform open wedge osteotomy.



PRE-OP

POST-OP

Figure 1: Shows pre-op and post-op.



Figure 2: Intra-Op IITV Image.

Discussion

Recurrence of adductus of the forefoot is an early sign of relapse in club feet treated by the ponseti technique. Majority of the relapses occur in the first 2 to 3 years of life [13]. Early recurrence following ponseti technique is usually dynamic in nature. Structural deformities occur later when the dynamic deformities are left untreated for longer periods of time. Dynamic supination in clubfeet occurs secondary to muscle imbalance resulting from a strong tibialis anterior muscle and weak peroneal musculature. These children supinate the foot during the swing phase, while appearing corrected in stance phase of Gait [14,15]. In most cases spontaneous correction occurs with maturation of muscle function [14,16]. Where dynamic supination persists, it may lead to progressive and persistent deformity [17].

We performed TATT in children between two-five years to correct the deformity. In our study four children required additional procedures with tendon transfer for correction which included posterior release, and midfoot osteotomies. We had minimum follow up of two years after surgery.

Tibialis anterior tendon transfer has been advocated as a treatment for residual deformities in congenital clubfoot since the 1940s [7]. The current evidence base for tibialis anterior tendon transfer includes a cadaveric biomechanical study [9]. In our study, we assessed strength, ankle ROM, foot alignment, function, satisfaction, and quality of life in patients by Laaveg-Ponseti score. At 12 months, these outcomes were not significantly different in 12 patients. Our results confirmed that transfer of the entire tibialis anterior tendon to lateral cuneiform effectively corrects dynamic supination as well as rebalances the foot in children with clubfoot having dynamic supination

deformity. The advantages of this technique are its simplicity, tendon maintains its normal position beneath the ankle retinaculum, which preserves its normal mechanics and prevents the tendon from bowstringing when the foot is dorsiflexed. Because of the complexity of the etiology and pathology of clubfeet we elected to evaluate only the muscle balance. We did not evaluate radiographic results.

Conclusion

TATT surgery is simple and effective procedure, to correct early recurrence in children treated by ponseti technique. TATT restores the balance of eversion-to inversion strength, alignment of foot, function and satisfaction outcomes similar to those of age-matched children with corrected idiopathic clubfoot.

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